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TEACHERS COLLEGE RECORD

Foreword — *Samuel Ralph Powers* — 217

The Social Role of Science — *Gerald S. Craig* — 219

Toward Unified Learning — *Anita D. Laton and Elsa Marie Meder* — 225

The Science Teacher and the Changing Functions of Secondary Education — *Samuel Ralph Powers* — 234

The Science Teacher and His Objectives — *R. Will Burnett* — 241

The Teacher of Science and His Community — *Hubert M. Evans* — 252

Teaching Science and the Individual — *N. Eldred Bingham* — 260

The Modern Role of Biology Teaching — *Paul F. Brandwein* — 265

The Modern Role of Physical Science Teaching — *Theodore D. Benjamin* — 272

Current Staff Publications • Departmental Notes

Alumni Activities

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TEACHERS COLLEGE RECORD VOL. 45, NO. 4, JANUARY, 1944

MAX R. BRUNSTETTER, *Editor*

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VOL. 45 NO. 4 JANUARY 1944

TEACHERS COLLEGE RECORD

Foreword

THE education of children and youth in our world of increasing intercommunication, conflicting ideas and desires, undeveloped resources, and widespread waste is a difficult and yet an imperative job. The results of scientific research and their partial application by technologists have brought into clear perspective the potentialities for better living throughout the world on a scale undreamed of a half century ago. The gap between realizable and unrealized potentialities is great even in our own nation with its comparatively high standard of living. The reducing of this gap is a major task of our time for the United States and for all other nations as well. The challenge to education is clear and compelling, and educators are accepting it. They are reorienting the program of the school and redefining its objectives and purposes in terms of the obvious needs of individuals and communities. It seems essential that the school take a strong position in response to this challenge if it is to be worthy of its central position in our culture.

An examination of the needs of community and of individuals clearly reveals the importance of education to enable children and youth to realize the possibilities which are their birthright. The approach of complete industrialization of society, with its consequent widespread and penetrating effect upon individuals and communities, must be taken into account by schools everywhere and in this the science teachers should assume a large responsibility. Problems relating to the allegiances and commitments of individuals and communities must be considered along with the problems of physical well-being and better living. Potentialities for better health, better housing, better nutrition, and a longer life span will be realized when the allegiances and commitments of individuals and communities become such as to promote, rather than obstruct, progress toward their realization.

The development of techniques for analyzing the needs and objectives of people and communities is of prime importance in the determination of educational objectives. Every community has its own crucial problems. Many of these problems have been created or made more complex by the research scientist, hence it is imperative that science-trained teachers take a leading part in helping children and youth and the community solve them. Objectives of science teaching should therefore be derived from an analysis of community needs, and techniques to implement these objectives should be derived from a study of community problems. The needs of children and youth will best be met through the kinds of learning experiences whereby they come to understand that their ultimate welfare is identified with the welfare of their community.

The problems of the community are generally broader than the scope of the special fields of science. Consequently, the competence of the scientific worker and the teacher who would deal effectively with these problems must be broader than the scope of any one science. Study of science must be integrated with study of people and society. For the teacher, it is urgent that his study of method and content in science be no less thorough than in the past. The fulfillment of the possibilities for better living cannot be realized unless the methods and findings of the scientist receive greater attention and understanding by all people in our society than they do at present.

A considerable body of practical experience has been acquired by teachers and schools as they have worked in their communities on problems of direct concern to the welfare of children and youth. The implications derived from an analysis of these experiences indicate clearly that much of the school curriculum can be organized around problems and needs of the community and individuals in the community.

In the articles which follow, the social role of science teaching is interpreted against the somewhat varied background of experience of nine science teachers. The authors have interpreted their own work and have made recommendations on the basis of their interpretations of needs and trends. One article reports on work that is being done in a number of widely distributed public and private schools. This issue of the TEACHERS COLLEGE RECORD is in a sense a progress report and as such it is a continuation of the issue of January, 1939.

SAMUEL RALPH POWERS

The Social Role of Science

GERALD S. CRAIG

PROFESSOR OF NATURAL SCIENCES, TEACHERS COLLEGE

SCIENCE is profoundly changing the kinds of outlook that man has toward the physical and biological aspects of the universe that surrounds him. It was natural for primitive man to conceive of the universe as populated with hostile beings, as he witnessed the eruption of a volcano, the terrifying force of a hurricane, the shaking of the earth, and other operations of natural forces. As a result of these observations, he tended to believe that he and all mankind might be destroyed at some time in the future. Such ideas have persisted through the centuries with amazing tenacity. There are many today with limited social vision who have little faith in man or his future, and as a result give slight consideration to problems that relate to the broad scope of man's welfare.

The ideas of the world that science gives us present an outlook of an entirely different character. The astronomer studies the stars and sees nothing with which the earth will collide for millions of years. The geophysicist studies the interior of the earth and finds it stable enough for the purposes of civilization. The paleontologist finds the earth has supported life for thousands of millions of years. It would seem then that man could safely plan for civilization as if he expected the earth to be a favorable place for life for a long period in the future.

Science gives us a new way of interpreting many of the disasters and catastrophes in human history. We no longer can view these as punishment sent by hostile spirits. The majority of disasters of recent years have been the result of man's failure to apply his knowledge in a cooperative manner.

Man has become an important factor in changing the environment. His continued existence and advancement are dependent upon his wise modification and utilization of the environment. In a few centuries he has greatly changed the North American continent. He has drained swamps, cut down forests, built cities, introduced exotic species, exterminated certain indigenous ones, built artificial lakes, changed the course of streams, and altered the original balance of nature. Not all of these things have been done wisely; some of them have brought disasters. In many cases it is after the damage has been done that man has sought scientific advice.

Species of living things have survived because they have tended by adjustments and adaptations to become better fitted to the conditions under which they live. In general, man is no

exception to this basic principle, but he can change the conditions of his environment to a far greater extent than any other kind of living thing. On the one hand, he can fear his environment, place reliance upon superstition and defeatism, and resign himself to what he considers foreordained and inevitable; on the other hand, he can utilize scientific knowledge, methods, and attitudes to the end that he may operate intelligently with the physical, biological, and social aspects of the environment for his own welfare and happiness.

So we see that the kind of adjustment man makes to his environment depends on the kind of ideas he has of the world about him. Unfortunately adjustment as a term has been frequently used to imply an attitude of complacency, a "Pollyanna" attitude of getting along with things as they are, a "be-thankful-for-what-one-has-but-don't-ask-for-more" way of thinking. This is contrary to the dynamic implications of science—the ability to improve conditions, the striving toward intelligent utilization of natural forces, and the inventive genius to develop what is needed. For science there is no mere complacent adjustment to the universe; power, progress, and intelligent action are implicit in the nature of science.

SCIENCE A NEW ELEMENT IN SOCIETY

Science is still a very new element in society and humanity has not had sufficient time to adjust its ways to it. Man has been on the earth as a distinct species for an unknown period of time—possibly as short as a quarter of a million years, perhaps as long as two million years. But although the origin of science as a way of thinking is sometimes traced back to the Greeks, as a systematic progressive development with a profound impact upon society it is a very recent achievement of the human race. It is no wonder that its full scope and significance to mankind is not understood today by the majority of citizens.

Almost every current social issue grew out of some scientific development or discovery. Some anthropologists contend that a new discovery or a new invention frequently has brought regression in a civilization or culture along with progress. For instance, the stone ax was used for purposes of brutality and murder as well as for accomplishing constructive tasks. Likewise, fire, gunpowder, the plow, and the airplane have been used destructively as well as constructively. Modern machines have promoted unemployment on the one hand while on the other science and invention continually produce new industries and new vocations. The radio, while making possible rapid communication, has also given opportunity for dictatorships to manipulate thought and action over wide areas. So mankind has found that discovery and invention have had detrimental effects on civilization as well as beneficial ones.

Realizing that science produced new problems for society, some have advocated that it take a holiday so that society would have an opportunity to

catch up. It is obvious that such a policy is impossible. A much better plan is for society to develop an aggressive educational program, preparing persons for the utilization of science for their own welfare. It is apparent that a more adequate social planning is necessary if man is to secure the benefits of science and to avoid unnecessary disasters, such as depressions, unemployment, and group strife.

SCIENCE CONSISTENT WITH DEMOCRACY

If science is to develop successfully there must be freedom of discussion, belief, and research. Scientists cannot be certain of their conclusions unless they have studied everything that relates to their discoveries. This calls for the privilege of discussion with others that may have contributions to make to their study. It demands that scientists have the right to be honest about their conclusions rather than that they be forced to publish false conclusions, as has happened in dictatorships. And so we see science has much in common with the fundamental principles of democracy; in fact, history shows that the rise of science had tremendous bearing upon the development of democratic principles in France, England, and the United States. Many of the early founders of the American nation were tremendously influenced by science.

Science influences society but in turn is controlled by society. It is important that society promote freedom of investigation and demand that the findings of science be utilized for the welfare of society. In terms of a given country such as the United States, it would imply that the government should encourage scientific research but in turn would expect such research to lead to better housing, transportation, communication, recreation, health, and comforts.

In science it is found necessary frequently to revise statements which have been accepted as facts in the past. Science teaches the importance of being critical minded. Many scientific discoveries and inventions are made because man is willing to challenge old ideas and patterns of thought. Science is concerned always with accuracy and clarity, and, therefore, dares not be hampered by preconceived opinions, prejudices, and superstition. Constant freedom of thought and speech is implicit, therefore, in the method and meaning of science.

SHAPING THE FUTURE THROUGH SCIENCE

Through science man has the opportunity to shape his own future. He can face his problem with poise and confidence. Through study he can gradually increase his control over disease and promote safety. Through research he is developing new synthetic products which can improve living conditions. Through chemistry and biology he is learning how he can improve his agriculture in order to provide sufficient food[1] for the requirements of the populations of the

[1] Mather, Kirtley. "Man's Physical Environment and Man's Behavior." *American Scientist, Sigma Xi Quarterly*, Vol. 29, p. 139, July, 1941.

entire world. Thus the old régime of scarcity can be eliminated; with planning and research there can be a sufficient supply of materials[2] to provide for all a standard of living much higher than the highest we have today.

Man knows how to bring the rivers under control and eliminate much of the destructiveness of floods, while giving himself more miles of water transportation and tremendous reserves of water power to provide for electrification. He probably will not be able to stop the earthquake and the hurricane but he can construct houses to ride the earthquake and can provide for warnings of the approach of hurricanes. In these ways science can be utilized to decrease loss of life and destruction of property.

The importance of this aspect of science can scarcely be overemphasized, for it brings with it an entirely new concept of man's relation to his environment. For thousands of years man struggled for the bare necessities of life—what he got he paid for usually with hard, back-breaking toil. He grew old while he was still young in years, because of the severity of his daily work. Only those who were the favored of despotic rulers escaped this back-breaking toil.

As long as there was a lack of energy to do work for man, a few attempted to exploit the many to get the work of the world done. But with the development of technology at the beginning of the Industrial Revolution, there arose an increased demand for skilled trades and for engineering. Another consequence was the development of the labor movement, with its demands for improvement in the status and the living conditions of the industrial workers. Associated with these trends came the demands for free public education for all.

Agriculture, like industry, has been profoundly affected. Farming has become a scientific vocation featuring tractors, selective breeding, soil improvement, scientific marketing, refrigerated transportation for products, and so on. Modern efficient farming has moved a long way from primitive agriculture.

Thus we find a direct relationship between the advance in science and the developments in industry and agriculture. Without the progress in science and technology, it is questionable whether the majority of the people would have had an opportunity to attain living conditions and democratic standards much higher than those of peasants and serfs.

SCIENCE AND IMPROVED LIVING CONDITIONS

Slowly the majority of people of many races and nations are beginning to realize that want and disease are no longer necessary. Any careful observer today can easily detect a swelling tide of demand for better living conditions, a demand which gives the present period the aspects of world revolution. Fundamentally this demand has arisen because the common people are beginning to realize that

[2] Furnas, C. C. *The Storehouse of Civilization*, p. 547. Bureau of Publications, Teachers College, Columbia University, New York, 1939.

science can be utilized to improve living conditions.

Here are the challenge and crucial issue for democracy, on which no teacher of a public school can remain neutral. It is her clearly defined task to reveal to children the possibilities for an improved era. The great test of democracy will be determined finally not so much in terms of its armed strength as upon its ability to make adjustment to the impacts of science. In fact, it is from an unintelligent world adjustment to the potentialities of science that the future causes of war are most likely to arise.

SCIENCE AND SOCIAL SECURITY

In a recent book Rusk wrote with regard to the potentialities of science as follows: "Much has been said recently about social security, but it is not a government committee or a government fund of gold in Washington that can guarantee security in old age and sickness and financial depression; it is science with its potentialities for the production of comforts and luxuries, medicines and means of curing disease, and so on."[3]

The wealth of a nation is no longer necessarily to be reckoned in gold and silver, but rather to be calculated in terms of the natural resources of that nation plus the collective intelligence and resourcefulness of the people. It is to be noted that the development and utilization of these three are dependent in large part upon education and science.

[3] Rusk, Rogers D. *Forward with Science*, p. 11. Alfred A. Knopf, New York, 1943.

This discussion suggests how important it is that everyone in a democracy, whether scientist or layman, should have an understanding of the place of science in society. As Bernal declares, "The first objective is to provide enough understanding of the place of science in society to enable the great majority that will not be actively engaged in scientific pursuits to collaborate intelligently with those who are and to be able to criticize or appreciate the effects of science on society."[4]

Science is a powerful tool which can be used for good and evil. Lin Yutang[5] has indicated that an ignorance of this tool and its potentialities can result in the extinction of western civilization. If democracy is to survive, the common people must become aware of the potentialities of modern science in the world community. This latter task seems to be uniquely one for the elementary school, since the elementary school is the school of the people.[6] The adjustment of society to the impacts of modern science must become a major concern of classroom teachers.

No one can furnish the teacher with exact blueprints of the kind of society that will be so adjusted; quite the contrary, adjustment must be continuous and society must go through many periods of experimentation. Children in the elementary school should become aware of the meaning of experi-

[4] Bernal, J. D. "Science Teaching in General Education." *Science and Society*, p. 2, Winter, 1940.

[5] Lin Yutang. "Christianity and Gun Boats." *Common Sense*, Vol. 12, p. 75, March, 1943.

[6] Caswell, H. L. *Education in the Elementary School*, p. 302. American Book Company, New York, 1942.

mentation; this applies not only to simple experiments in science, but also to planning relating to their own affairs and on their own levels of understanding in the school, on the school ground, and in the community.

THE CHALLENGE TO EDUCATION

It is evident that many individuals have faulty concepts of what constitutes dependable information. Gullibility, superstition, unfounded prejudices, dogmatism, and reliance on gossip are still characteristics of thought patterns in the middle of the twentieth century. This condition of scientific illiteracy is as precarious for the survival and advancement of a democracy as the inability to read or write; those who are not skilled in recognizing the fundamentals of truth constitute the inflammable raw material for intolerance, despotism, riots, bigotry, and mass hysteria.

The teacher needs to learn where the child is securing his information and how reliable those sources of information are. It is his responsibility to assist the child in developing the knowledge of where and how to secure accurate information. Through education, the child should gain some understanding of how man goes about the task of discovering what is reliable information.

It is time that the school strike out boldly for the kind of education that is in keeping with modern times. All too frequently the school has been enmeshed in traditional curricular patterns and has lost sight of the larger functions for which it was created. Today social development is seriously impeded because a large percentage of the population insists on enjoying the modern achievements of science and technology, while at the same time retaining medieval patterns of thought and attitudes. These are so incompatible that we experience periods of war and peace, of prosperity and depression. The continuation of such a course leads to exhaustion of the natural resources of the earth, to the loss of present civilization. In light of the developments of recent decades the school can ill afford to follow its complacent way.

It has been indicated that science has tremendous potentialities for the improvement of social conditions. To secure these potentialities the people must be educated to utilize the full resources of science. This calls for far greater attention to the development of desirable social behavior in children. The public school must assume the responsibility for the development of a generation that has the ability to meet its problems, both personal and social, with intelligence and resourcefulness.

Toward Unified Learning

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TEACHING is effective when it is rooted in the needs and problems of people in the community and its schools. This principle has certain implications which, when accepted, have led to changes in courses and curricula. It implies, for one thing, that teachers must know their communities and must plan their teaching on the basis of this knowledge. It implies also that they must use their special professional knowledge and skill to help students recognize and attack their problems. And, since people's needs are not compartmentalized according to the subject matter of high school courses, it implies that teachers having various specializations must work together to contribute to effective education.

The efforts of the Bureau of Educational Research in Science at Teachers College have been guided by this principle and its implications. The Bureau has been working in close cooperation with science-trained teachers and with school systems in many parts of the country. Teachers in each of the cooperating schools have undertaken to study their communities. Their studies have been of varying degrees of comprehensiveness and have been utilized in different ways.

THE COMMUNITY SURVEY

One of the most elaborate community surveys was the joint responsibility of school people and representatives of other agencies in the city. Its purpose was to determine what community resources were being used for the education of young people, which of these could be more effectively employed, and what resources, at present not serving educational purposes, could be adapted to such ends. The final report organized the information collected under titles such as Health, Government, Recreation, Industries, and Consumer Education, and gave detailed suggestions to teachers concerning trips their classes might take, speakers who would come to the schools, publications and other material supplied by various organizations, and assistance students might render in community affairs.

A community survey somewhat similar in scale has been in progress for several years in another city. This survey was initiated by a science teacher who presented a plan for study to the instructors of the high school in which she teaches. About fifteen teachers volunteered to accept responsibility for carrying out the various sections of the plan. These teachers in turn enlisted the cooperation of other teachers and, in many cases, of students as well. The purpose of this survey is, in general, twofold: to acquire a better understanding of the community and of the problems with which young people living in it are faced, and to discover what material concerning the community should be incorporated in courses of study in order that students may use community resources to better advantage.

The material gathered is being used in several ways. The teachers immediately concerned with the study are incorporating the information they have gained into their own courses and are applying their increased understanding of the community to the problems which arise in their classrooms. A new course centered on study of the community is being offered this year to enable the teachers to share some of their new learning with the students. A report is being prepared for general distribution to the teachers of the school. The science teacher who planned the study and under whose leadership it progressed is discussing it with groups of teachers in other schools throughout the city. The administrative officers of the school system are sponsoring these meetings in the belief that once teachers have gained the broader understanding of their community which the data make possible, they will relate their teaching more closely to the lives of the young people who are in their classes.

In other communities, teachers have attempted similar studies and have found themselves constrained to modify their teaching in the light of what they have learned. A biology teacher who concentrated on a study of the health problems in his city found it desirable to introduce a unit entitled "Better Use of Existing Health Facilities." A chemistry teacher's survey of the industries of her community led to more thorough study in her classes of the processes fundamental to the city's industries; to a study of the city's relation to the rest of the world through its intake of raw materials and output of manufactured articles; and to a prevocational emphasis for some students on techniques used in the city's industrial laboratories.

PROBLEMS OF COMMUNITIES

Teachers who measure their teaching against the standard of helping students attack problems become aware not only of the need for enriching the courses they offer but also of their own inadequacies. In one school a science teacher whose students were the sons of men in important managerial positions became convinced that his students needed a comprehensive picture of the interchange of materials over the globe and an under-

standing of the problems of conservation of material resources, of labor, and of economic adjustments dependent upon that interchange. His specialization in chemistry and physics had not been designed to help him develop these understandings in his students. He enlisted the aid of the economics teacher. Together they developed a course in chemistry and applied economics which had three stated objectives: (1) To provide a background for understanding the flow of materials and energy in the conversion of natural resources to consumable goods and services, and for understanding the problems which arise for human beings in the process. (2) To develop the ability to use, and the habit of using, scientific methods in thinking about natural and social phenomena. (3) To develop the desire and ability to act upon the results of such thinking.

The class in "chem-ec" met daily for two consecutive periods with both the chemistry and the economics teacher present almost all the time. Laboratory work, films, and reading material were used extensively; trips through industrial plants, although undeniably pertinent, were impossible because of the war. At the end of the year, the two teachers felt that the experience had been valuable to all concerned. They stated that "chemistry and economics learned together have more value than when studied separately" and that the boys gained decidedly in appreciation of the impact of science on society. They based these statements on the results of a careful testing program as well as upon subjective evaluation.

This course was offered in a private school with small classes and comparatively few scheduling difficulties. However, a somewhat similar course was developed in a very different situation—a public high school with 4,600 students and the administrative problems usually found in a large city school.

A science teacher in this school had been rethinking the purposes for which he was teaching. He had decided that it was his function to help students become more aware of the problems around them, and his responsibility to help them attack these problems. But he realized, as he said, that problems "do not come wrapped like Christmas packages and labeled 'for the science teacher' or 'for the history teacher.'" Consequently, he became interested in formulating a course which would cut loose from subject matter boundaries and be concerned with problems of people. He secured administrative consent and began work on such a course with a committee of teachers, including representatives of English, social studies, mathematics, and home economics.

The committee worked throughout an academic year. Its thinking was influenced by the following three assumptions: (1) One of the things people do least efficiently is to work as equals with others in attacking and solving common problems. Traditional methods of teaching with emphasis on individual initiative and solitary study have not improved this condition. (2) Problems generally ramify into

many subject matter fields, and the usual specialized course can attack only parts of the problem. However, the whole is more than the sum of its parts. (3) Each community has its own problems, although they may resemble those of other communities. An effective attack upon them demands that courses be especially adapted to a particular community.

Acting upon the third of these assumptions, the members of the group attempted to describe as fully as possible the community and the school situation in which they were working. The description, together with the implications of the first assumption, led them to state three objectives for the new course. One was the development of a social philosophy based upon scientific principles and involving a recognition of the relations of local community problems to those of human society in general. Another was the development of a desire for constructive social action leading students directly into active participation in efforts toward community improvement. The third was development of the ability to work cooperatively in analyzing problems and in planning and carrying out attacks upon them.

In the light of the second assumption and of community descriptions, the committee identified several problems around which to build the new course. These were designated by the general terms Housing, Intercultural Relations, and Social Hazards. The teachers felt that there were real and pressing community problems in these areas, as did selected students who were invited to meet with the committee.

Each of the areas has aspects which are primarily in the field of the social studies; each also has aspects which are primarily scientific. Consequently, the committee decided that the new course should be assigned to the science and social studies departments, and that students electing it should receive credit in both subjects. This decision proved satisfactory to the administrative officers of the school, who assigned the same group of students to the same room for two consecutive periods, one with a science teacher and the other with a social studies teacher. However, neither had an assignment for the alternate period; thus both teachers could be with the class during the entire double period.

A social studies teacher and the science teacher who had initiated the work took over the planning at this point. In the spring they consulted the students who were to take the new course and held several informal conferences at which teachers and students together planned for the fall. During the summer they worked intensively and cooperatively to enrich their own backgrounds.

Four classes have taken the "Community Problems" course. With each class the emphasis was placed on student participation in planning and in cooperative attacks upon problems. This emphasis made for flexibility and precluded the possibility of rigid schedules of work. Each class studied the housing situation in the community with regard to the social,

economic, and technical problems involved. The students considered the origin of existing conditions, their consequences, and possible methods of improving them. Exploration in the area of housing led to recognition of problems related to group differences. Here historical study was directed toward understanding how group antagonisms arise, and scientific study was concerned with what is known about race and race differences. Attention centered also upon solutions which have been proposed and tried for "racial" problems.

While working in the areas of housing and intercultural relations students developed heightened awareness of the uneven distribution of wealth and of the varied ways in which people strive for security. With each class the final weeks of the course were devoted to an exploration of problems of social and economic security. The social hazards considered were of two sorts—loss of income and loss of health. Students' work was concerned with efforts which have been made in the United States and elsewhere toward security for individuals and groups of people. It included study of the vital statistics of the city and of the function of public and private health agencies.

The course in Community Problems was evaluated by an independent commission which recently made a survey of the activities of the school. This commission reported as follows:

> Anyone who will take the trouble to become thoroughly acquainted with the general outline provided for this course, the procedures used, the activities undertaken, the complete subordination of subject matter to the goals set, the sensible relationships that existed between teachers and students, and the measured outcomes on the basis of informal but valid tests must come to the conclusion that, given the necessary freedom from the usual restraints imposed by a system more interested in granting diplomas and college calling cards than in educating young people, this course was in all essentials what good secondary education should be, measured by any set of generally accepted criteria.

PROBLEMS OF HUMAN LIVING

Cooperation between science and social studies teachers is obviously reasonable; the body of content of the social studies and that of the sciences are complementary. However, in some Bureau schools it has been more feasible for science and English teachers to cooperate.

In a private experimental school a science teacher and an English teacher work together in a tenth-grade course in "Problems of Human Living." The purpose of the course is to help boys and girls to understand their growth and development in a meaningful social perspective. Problems associated with understanding oneself as a biological organism intimately interrelated with other organisms and with the physical environment are approached and studied from biological, psychological, and anthropological viewpoints. Problems of living satisfactorily with others in a family unit or other social group—a natural outgrowth of the study of the individual—are considered as problems of adjustment to group living.

The two teachers meet the students daily for a double period. The year's work began with a discussion of differences among class members—in age, dress, size, coloring, mathematical ability, sex, and family background. The discussion, led by the science teacher, was followed by a consideration of the changes which occur in an individual as he goes through life and a listing of the stages in the life span. At this point the English teacher interpolated a question as to Shakespeare's statement on the seven ages of man, which led to reading and discussing *As You Like It*. The students decided that Shakespeare's statement as to changes through life was accurate so far as it went, but "unfair to women." They attempted to write descriptions which would be fair to both sexes; when these were read, the students found that "they did not sound like Shakespeare." This observation introduced some study of scansion and blank verse and a reworking of the students' productions into iambic pentameter.

As a part of the early work of the class, each student placed himself on a time line. At first the students thought of their development as occupying a very short period of time. Gradually their ideas were extended, going back, first to conception, next to their ancestors, and finally to the long line of beings which lived on earth before the emergence of man. Similarly, they thought forward to maturity and old age, with death as an inevitable and necessary step in the continuance of life as a whole.

Students who have taken this course have stated that they learned "quantities of facts." Their information was acquired from many sources. They made considerable use of textbooks, general references, and popular books in the fields of physiology, genetics, psychology, sociology, and anthropology. They read a wide variety of books and articles of the sort termed literature. They saw a number of pertinent motion pictures. But in so far as possible, information was gained through first-hand experience. Laboratory work included emphasis upon psychological experiments as well as upon physiological studies and biochemical techniques. Field trips were made to hospitals, nursery schools, and other places where children could be observed and studied.

Experiences in writing gave an opportunity for careful organization of scientific facts and contributed to the development of clearness in exposition. In addition, students reworked some scientific material imaginatively in prose and poetry; they wrote humorous jingles on the implications of some of the facts they learned; and they prepared criticisms of pseudo-scientific and popular scientific books and articles.

Perhaps the most important class activity was the writing of autobiographies. For these the students organized the incidents they remembered, consulted people and records, and compared their own development with that of children in general. Emphasis was placed on reliability and objectivity by the science teacher and on

interest and readability by the English teacher. The result was a series of life histories, honest and objective, related to our knowledge of human development, interesting because of their style and organization—unique documents telling stories which only the writers could tell. To the teachers they were of importance in evaluating the course. Evidence obtained from these autobiographies, from other written work, from test responses, and from students' behavior in and out of class, made it possible for the teachers to identify certain aspects of student achievement. Recognizing the subjective character of much of their evaluation, they felt, nevertheless, that there were definite student changes in the direction of the following: (1) Clearer understanding of the biology and chemistry of the human body. (2) Better grasp of problems of personal and community health. (3) Better understanding of the family as a social unit and of the problems of family living today. (4) More objectivity in thinking about themselves and their intimate associates. (5) More useful perspective on man's relation to other organisms. (6) Increased ability to present scientific material clearly and objectively. (7) Increased ability to think and write imaginatively.

INTEGRATED COURSES

In the course in "Problems of Human Living" no attempt was made to enliven subject matter. Nor was the purpose primarily to integrate science subject matter with the subject matter of English courses. The emphasis was on bringing knowledge of science and the heritage of English language and literature to bear upon the problems of the individual. Similarly in the Community Problems course, there was no attempt to equalize the emphasis given to science and to social studies. Each of the two bodies of information was drawn upon as it was needed for functional comprehension of the problems of the community.

There are times when this attitude cannot, for one reason or another, be adopted save as a goal toward which to work. Sometimes the first step toward unified learning is a very specific attempt to integrate two subjects, that is, to look at each body of knowledge and to determine where it impinges upon the other. In one school, for instance, a chemistry teacher noticed that frequent reference to the city's development was necessary during her attempt to help her students see the significance of chemistry in community activities. She became interested in achieving a correlation of the work in chemistry and the work her students were doing in their American history classes. Sweeping changes in course content were not feasible, nor was it possible for scheduling to be controlled so that the same group of students could be assigned to chemistry and history classes in consecutive periods. But it was possible for the chemistry and history teachers so to plan their work that they considered related topics at the same time; for example, classes in both subjects studied the city's water supply—each from its own angle—during the same weeks.

The integration of subject matter can be extended beyond the dovetailing of two courses. One school—a city school with 2,000 boys as students—has for some years been working toward a ninth-grade curriculum in which all subjects should be integrated: English, social studies, science, mathematics, art, and music. The aim has been to make work in all courses of study contribute to the understanding of certain areas of living, without sacrificing advantages usually considered to be those of a traditional high school curriculum.

The curriculum reorganization has been in large part carried out within the framework of departmentalized subjects. The students move from class to class at the sound of a bell. Yet in each class they may be working on the same large topic; for example, food, health, housing, government, or economic problems. Topics such as these have been found to be good organizing centers for practically all the important material commonly taught in ninth-grade English, social studies, science, and art, and for some of the content of ninth-grade mathematics and music. The general pattern of the work is the same for all courses. However, no effort is made to force any subject into the pattern. When, in the judgment of the teacher, a subject has only a limited contribution to make to a topic—as music has in connection with the topic of housing, for instance—the teacher proceeds instead with an "independent unit" of study, one which serves the ends of his subject rather than the broader aims of the integrated program.

There has been little difficulty in synchronizing the work of the various teachers. All are in fundamental agreement that the purpose of the program is to implement the aims of general education, and all have been willing to plan their courses carefully and with reference to the plans of others. Because they recognized that for their efforts to be of most value they must conform to certain practical limitations, they made no attempt to modify conditions of class size, teacher load, program rigidity, and the like.

The work began as a controlled experiment. A carefully conducted evaluation program showed that there was no difference in mastery of subject matter between students in the integrated curriculum and students in traditional ninth-grade classes. The experimental group made higher scores on non-informational tests, such as a test of skill in using scientific methods. These results, together with the subjective judgment of the teachers, have led to the extension of the integrated program to the entire ninth-grade group and to the continuing reorganization of the curriculum in terms of the problems of people.

Experiences in schools cooperating with the Bureau of Educational Research in Science show how science teachers have modified their work as they have become students of the needs of the community and the young people living in it. As they have grown more sensitive to problems, they have recognized their obligation to help people face them, and have seen the func-

tion of science teachers as that of using their competence wherever it may be of value. At present the task of science teachers is peculiarly challenging. If peace is to be lasting, plans must be laid on a world-wide scale to develop latent resources, to increase productive power, to raise standards of living, to maintain the flow of materials and energy through communities, and to enable men to see themselves and their communities in a rising scale of well-being within the framework of international relations. It is essential that the peoples of the world, including students now in school, be able to understand and participate in such planning.

The task is a tremendous one. But it is not the task of science teachers alone; it is the task of all education. As teachers work together toward unified learning, their students may begin to realize that the problems of a single community reflect and ramify into regional, national, and world-wide problems, may begin to grasp the concept of the interdependence of persons, of communities, of regions, and of nations.

The Science Teacher and the Changing Functions of Secondary Education

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THE objectives of education are derived from the needs of people and the communities in which they live. The interpretation of needs as stated by policy-making bodies for secondary education today is sharply in contrast with the interpretation made a generation ago. When the high school population was highly selective of boys and girls seeking education for the professions, the educational need was interpreted as preparation for college. More recently, attendance in high schools has expanded and is progressively less selective of any special group. With this enlarged attendance, the secondary school is becoming our American institution for the education of all the people to live and work together.

The pressure of the war has brought to our attention an acute awareness of our needs for education to help us live and work together through the emergency. These are only extensions of peacetime needs that make us realize the urgency of education that is immediately functional. Good health and physical fitness are always vitally important to individuals and the nation; work experience for young people will serve them when the world is at peace as well as now; and we have long realized that an understanding of production and consumption is necessary for satisfactory living in this age—certainly such an understanding will be an extremely important postwar need. Equitable distribution of the resources that enable people to enjoy a high standard of living is a basic issue of the war. Production and distribution were vital factors before the war; they will be of increasing importance everywhere when the war ceases. The world has great resources and capacity to produce enough for everyone, yet many people have not had and do not have enough of the necessities of life. War or no war, education must be sufficiently functional to help everyone achieve the benefit of the world's resources.

EDUCATION FOR LIFE

It is implied in current interpretations of educational needs that young people shall gain while they are in school experience and preparation for dealing with the issues and problems they will meet in life. This means

preparation to live and to construct a way of life in a world in which there are facilities for raising the standard of living and for achieving an interpretation of the world that is in agreement with practical experience. Knowledge and techniques are at hand for greatly reducing the incidence of disease and for further extension of the length of life. Foods may be produced in abundance, sufficient for the needs of everyone. Materials and energy may be made available in practically unlimited amounts. The boundaries of knowledge have been extended to include detailed descriptions of the life process and of the changes and relationships in and among the astronomical bodies that make up the physical universe. As men gain experience in working together they may learn about each other and about how to work cooperatively. These and related matters have been for a long time on the fringe of living—a challenge to the ways of life that developed before these knowledges and skills and the careful and detailed descriptions of processes were available. In the successful prosecution of the war we have used these skills and knowledges as resources for improving health and well-being; for producing energy and materials, including foods; and for interpreting the behavior of our own people and of allied and enemy people throughout the world. Such things are no longer on the fringe of life, but are now thoroughly enmeshed in it. Secondary education is education for that life.

Obviously, science-trained teachers must play an important part in helping youths to find their place in life. These teachers will improve their services to youth as they learn more about the immediate and practical problems of today, and about how to use their special competence in science in dealing with them. There are many illustrations of issues calling for vital decisions in which all must share.

IMPROVEMENT OF HEALTH STANDARDS

Biological knowledge is at hand for use in improvement of health standards and extension of the average length of life. Decisions must be made as to what we shall do with this knowledge. During the first forty years of the twentieth century three diseases—diphtheria, typhoid fever, and scarlet fever—have been brought so nearly under control that death from any one of them is rare. Techniques are now available for similar control of tuberculosis, syphilis, malaria, and possibly of lobar pneumonia. But the sufferers themselves must have a more detailed knowledge of these diseases and of their own bodies. There is hope and expectancy of further improvements through study of endocrine glands and therapeutic use of glandular extracts, extensions of nutritional knowledge, and continued research on substances to stop the growth of pathogenic organisms within the human body. As a result of these and other controls, the proportions of young and old are changing. A baby born in America today has a life expectancy of sixty-four years—thirteen

years more than the life expectancy of a baby born in 1920. Competent medical authority has expressed the opinion that further efforts in conserving human life may result in extending the life span to one hundred years for a considerable proportion of the population. With these many controls, and with the realization that further improvements may be attained, we may raise the question in a practical sense: Shall we apply this knowledge to the further extension of the length of human life? How much of it and how thoroughly? There is no doubt that as much as one fourth—and probably even a larger proportion—of the deaths now occurring in any age level below fifty years are preventable by application of measures that are well known.

IMPROVEMENT IN USE OF MATERIALS

Science teachers should also have the basic education for competence to help young people deal with problems of production and use of materials and energy. Specifically, they can help their students to consider questions about their own communities, the nation, and the world at large: Can we build houses for everyone? Have we the resources in metals and can we produce energy for a continuous and expanding economy? Can the United States play the role in the world economy that is implied for us in the Atlantic Charter? Consideration of these questions will lead to extensive revision of previously accepted notions about conservation and use of our resources in soil and in materials and energy.

Advances in technology have come so fast that there is indeed a sharp contrast between practices and potentialities in the use of natural resources. Great achievements have taken place in a very short time. Undoubtedly, more will follow rapidly. Our vast system of electric power and light has developed during the lifetime of men now living. The first commercial generating plant was built in 1885. The telephone, automobile, motion picture, airplane, and radio are developments of the twentieth century. A large percentage of the expenditure from the family budgets of the nineteen-forties is for items unknown or unavailable to the generation immediately preceding this one. It is changes such as these that have made modern communities so largely different from those that existed at the time when the secondary school was taking shape as an institution.

INCREASE IN PRODUCTION

The war has given us tangible evidence of our capacity to produce. For one thing, we know now that it is possible to establish a permanent system of agriculture with a high level of production. The combination of improved genetic quality of plants and animals and improved soil fertility points the way to what amounts to practically unlimited agricultural production. Increased production is possible even in the extremes of the Arctic. Productivity of the soils in our rich agricultural regions has been in-

creased enormously during the past decade. It is reported that increases in yield of corn per acre, when hybrid seed are used instead of seed from open pollination, are as high as 30 per cent. We may show by comparison what it would mean if this increased production were attained by all corn growers. The total production of corn in the United States is somewhat more than 2 billion bushels. A 30 per cent increase would equal 600 million bushels. One bushel of corn (56 pounds) may be processed to yield 25 pounds of dextrose sugar, and this in turn will yield about 12 pounds of alcohol. Thus a 30 per cent increase in yield of corn would be raw material for the production of 7.2 billion pounds (or 3.6 million tons) of alcohol. This is far in excess of the total production of industrial alcohol in 1941. Alcohol is raw material for synthetic rubber, and the total amount that may be obtained from the increase in yield owing to use of hybrid seed is apparently more than sufficient to meet all our needs for rubber.

Increased production of animal foods has resulted from better feeding and from breeding. Chickens have been bred to produce 300 eggs a year, and cows have been bred for greatly increased yield of milk. The record for milk production for a single cow is 19,500 quarts of milk annually. Average production in the United States is at the rate of 2,200 quarts per cow, or 55 billion quarts from our present population of 25 million cows. This is sufficient for a little more than a quart a day for each of our 130 million people. Obviously, the quantity of production could be increased enormously.

In considering the supply of natural resources we must recognize the change from the point of view that prevailed when we thought of metals, energy, and food resources as scarce. With new developments in technology has come the realization that none of these resources is scarce. During the interval of 1917 to 1940 the amount of ore taken from the ground equalled that removed during all previous time. The rate of production has been increased enormously since the war began, and depends only upon manpower for still further increases. In 1940 roughly 200 million people were living on an economic plane comparable to that of the United States. Industrialization of the undeveloped parts of the earth will require a tenfold increase in the use of resources; but there are vast areas throughout the world in which resources in metals, energy, and soil have hardly been tapped. In the United States we have the capacity for production of metals in excess of our needs. Our richest deposits of iron are nearing exhaustion, but we have great reserves of lower grade ores. Aluminum is already replacing iron as a structural metal, and magnesium will undoubtedly come to have extensive use in the metals industries. For practical purposes our reserves of these metals may be considered inexhaustible.

There are no practical limits to our capacity to produce building materials. While the lumber industry is being stabilized so that rate of growth equals

rate of cutting, we are using increasingly large amounts of processed material for building. Most of this processed material is derived from cellulose.

WISE UTILIZATION OF MATERIALS

The problem of wise utilization is added to the problem of increased production, and its solution also depends upon *application* of knowledge already available. Here again, application of knowledge is largely an individual problem. First of all, individuals must select occupations on the bases of what are available to them; what they are fitted, by both temperament and training, to do; and what will contribute to the increased production necessary to maintain a high standard of living. The science teacher can give his students vocational guidance by helping them to study and to take part in the occupations available in their own communities and to learn about the place of these occupations in the total economy.

As consumers, individuals will contribute to stabilization of our economy and to their own personal comfort and happiness if they purchase materials of maximum utility. They can make such selection only when they have complete information about products. For example, in building construction the loss of heat through walls can be reduced as much as 75 per cent by using asbestos or glass wool to fill in the air space commonly left within walls. This construction not only reduces substantially the cost of heating, but makes possible more uniform, and consequently more comfortable, conditions in a house.

Experience throughout the war has shown us that, in practice, capacity to produce is limited only by the demand and by manpower. We are now in a position to choose between production in abundance for all—insofar as we have manpower—of houses, food, clothing, radios, automobiles; and limited production of these things for a favored few. Our youths will need the help of science-trained people as they prepare themselves to take their place in a world in which decisions such as this will be asked of them.

TRANSPORTATION AND COMMUNICATION

Accelerated transportation and increased communication are also evidences of application of knowledge and of our capacity to produce. Aviation has made the world a small place as far as time required for travel is concerned. Recent international conferences in Teheran, Moscow, Washington, and North Africa represent no more in time than conferences in, say, Chicago attended by delegates of the United States alone. For the first time in history, the entire world is in communication. The radio makes it possible to "listen in" to the whole world, instead of depending on reading. We can be sure that after the war television will enable us to "look in" on events as they occur.

With developments throughout the world being reported on the radio almost as soon as they happen, and with

trends toward world cooperation as a means to prevent war, it is no longer possible to think of any nation of the world as unrelated to all the others. This intermingling of nations necessitates cooperation within and among nations if the various peoples of the world are to live peacefully. In learning about cultural groups, we have found that others have the same competencies and capacities as we do. Because some cultural groups have the traditions of oppressed peoples, their ways of looking at life may be different from ours.

The biological differences between racial groups are generally not very large; behavioral differences are for the most part culturally determined; and greater differences in abilities, personality, and native aptitude occur within cultural groups than among them. No specific group has all the vices or virtues. Only by appreciating the basic intelligence and ability of other cultural groups can we accept their differences and understand and cooperate with them in projects mutually advantageous.

The increasing tendency to inquire concerning the nature of things and to try to find the answer through examination has furnished the reservoir of information that has been used in increasing our competence in production, consumption, and physical fitness. The foundation for it all is so-called pure research. Our interpretation of the origin and development of life on the earth, based upon observations of changes in progress today and of fossil remains of other ages, leads us to an understanding of plant and animal life and of man's place in the universe.

The science teacher who understands the scientific nature of the world and of the universe will be better prepared to guide the thinking of young people. The reservoir of knowledge about the world which man has used to increase his competence to maintain health and to produce goods is also a reservoir of ideas out of which he is constructing new conceptions of values. Concepts of time, space, reproduction, evolution, growth, the earth's position in the universe, are of special importance for science teaching. Young people experience a great deal of conflict and emotional difficulty as they encounter new knowledge that apparently is inconsistent with previous beliefs. The science teacher has a special responsibility to aid his students in achieving satisfactory orientation in the midst of these cross currents of thought.

THE DIRECT APPROACH

Current trends in secondary education appear to be toward organization of the curriculum to favor direct approach to the study of issues of immediate significance in the lives of youth, with teachers contributing according to their competence. Achievements in science have had an important bearing on setting current issues. The science-trained teacher must take an active role in such a curriculum if youth are to consider these issues comprehensively. However, the administrative pattern for the curriculum of the future is by no means clear.

Science-trained teachers in the schools of today are generally working within the boundaries of their special subjects, and for this they must have thorough education in the subject matter of science. They will adapt their teaching to the educational needs of youth as they themselves become students of these needs. The biologist, the chemist, and the physicist have affected national and world economy through their contributions to biological production; to production of processed materials—plastics, metals, and chemicals; to increased efficiency in production and utilization of energy, particularly in the form of electricity. At the same time, the findings and the applications of the findings of these men are more and more affecting conceptions of values and the ways of people as they live and work together. In large measure the educational needs of youth are for help in making adjustments to living in a scientific world. Specifically, the science-trained teacher should help young people to acquire and gain practice in the use of the vocabulary of science in the discussion of current issues and problems, to achieve enough understanding to use the methods of science in their daily lives, and to collaborate intelligently with those who work in science as specialists. The teachers should help students to make science as much a part of life in school as it is of the society in which they live and work.

The educational needs as developed here are shared by all. Some will ask whether there is a place in the changing high school for the study of science as a field of special interest. The answer is yes. A special function of secondary education is to help each youth select and gain proficiency in a special field. Under guidance he will select according to interest and ability. The furtherance of some of these interests will require that they be carried on through studies in college; others will lead students into work that does not require a long period of pre-training. It is reasonable to assume that several special-interest fields will be offered (in large schools, many), and that approximately 20 per cent of a normal high school population will choose science as a special-interest field. If specialized courses are planned for the 20 per cent who have specialized interest in them and competency for them, then they should be offered as thorough courses adequate for strong preprofessional training—in contrast to the way they are now presented.

In considering the future of science teaching there are two major needs to be recognized. One is for general education of all to share ideals and work with intelligence and cooperation for the advancement of the common welfare. This is a big job, and in this we work not really as science teachers teaching our subjects, but as science-trained persons—as scientists, that is—helping young people meet the situations common in life. The second need is to help each youth find a field of special interest and to study intensively in that field. To the service of these needs our science-trained teachers are challenged to exert their best efforts.

The Science Teacher and His Objectives

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SHORTLY after Pearl Harbor I participated in the oral examination of a graduate student in education. The question was put: "What figure will history disclose to have had the greatest influence on American education during the first half of the twentieth century?" Without hesitation the response came: "Hitler." At the time I evaluated the response as correct and insightful but hardly clairvoyant. For it appeared to me rather obvious that the certain and grim struggle which we would face for many years would catalyze and greatly accelerate the normally slow processes of curriculum evolution. I was certain that the war would force the science teacher, particularly, to be increasingly realistic and functional in his teaching.

Now, after many long months of war, during which time I have been in a position to witness a fair sample of wartime science teaching in the secondary schools, I find that the assumption that war would bring early and significant curriculum changes in science education has not yet been justified. Many more young people are studying certain areas of science at present than before the war and many courses are offered under new titles, but analysis of the offerings discloses the same organization and the same content that has been traditional in American secondary schools for many, many years.

Perhaps this is all to the good. Perhaps the best possible selection of content, organization, and teaching procedures have been evolved through the experience of the years and are making optimum contributions to the needs of young people and society in wartime. But this possibility certainly must be submitted to critical analysis, for we have a grave responsibility to young people who are studying in our schools today, who will fight and work for victory tomorrow, and whose informed intelligence must be directed to the tremendous problems of a postwar world.

APPROACHES TO SECONDARY SCHOOL SCIENCE

There are three traditional major approaches to curriculum construction in science. These may be categorized as the "field covering" approach, the "generalizations" approach, and the "needs" or "functional area" approach. An examination of teaching practice, of textbooks and other curriculum materials including evaluation instru-

ments reveals that most teachers offer knowing or unknowing allegiance to the field covering approach; a minority offers at least lip service to the generalizations approach; and only an extremely small group attempts a functional or needs approach.

If we could assume that teachers adopted an approach because they had subjected it to critical analysis in the light of certain objectives and criteria, we might also assume that group experience and judgment had found the field covering approach to be the most satisfactory. Unfortunately, the majority of science teachers have not critically examined the basic assumptions underlying their offering or the criteria from which their objectives and curricula were derived. Rather, they have been prone to accept ready-made whatever emphases and content training, tradition, and present textbooks and standardized examinations have dictated. Therefore, we must critically examine the nature and orientation of the science curriculum rather than assume that the experience and expertness of the science teacher have provided *ipso facto* support for the traditional procedures and content.

The Field Covering Approach. Basically the field covering approach, as most commonly accepted, is an attempt to analyze the complete archives of science and to select, judiciously, "fundamentals" upon which may be built later studies leading ultimately to research specialization. It is a "logical" organization of subject matter presumably basic to further study in the area.

The field covering approach encounters difficulties today not faced one hundred, fifty, or even ten years ago, for our fields of science have taken tremendous strides in recent years. The basic sciences from which our high school physics, chemistry, and biology have been developed have tremendously increased and have produced hybrid offspring such as astrophysics and biochemistry. Obviously the job of sampling these fields and of making selections of what is deemed fundamental is a tremendous one.

How, then, do we decide what samplings of "fundamental" materials from the limitless archives of science to take? Is it less "fundamental," for example, for a student to know something of the nature of histamine and the physiological effects of the action of histaminase on histamine than it is for him to know the names and action of ptyalin, pepsin, and trypsin? The former has never been treated in any high school textbook to my knowledge and the latter has been presented almost identically in practically every recent biology textbook. (No author or publisher could omit it and expect the necessary sales.) Why? What is fundamental? The digestive enzymes will continue to function or malfunction regardless of a student's ability to give them names and pass that off as scientific learning. But the field of hypersensitivity and the enzymatic action of histaminase in the destruction of histamine in the body *may* lead a young person to understand something of one type of asthma and skin sensitization to the possible betterment of his

health through better cooperation with physicians.

Probably not, however. I have purposely presented two rather educationally meaningless bits of scientific data to address a point. Which set of data is fundamental? Which, if either, shall we select in our sampling of the field of biological science? Why has one been selected rather than the other?

The last question is easy to answer. High school science textbooks have not changed materially for lo these many years. When the earlier textbooks were written, the investigations of science had produced data regarding the digestive enzymes but none on many of the other enzymes involved in protein metabolism in the body. Consequently the higher learning designed to train the research workers of an earlier day concerned itself with teaching a logically organized body of subject matter so that the unknown could be attacked with the fullest mastery of information attainable. An inevitable, and still continuing pressure, was put on the lower schools to provide training on which the higher learning could more expeditiously be based. Much of the scientific data which are truly fundamental to our technological age, and which might have very real personal values in the well-being of young people are not taught in the introductory and semi-advanced college courses but are found in the professional training of engineers, medical doctors, etc. As teachers who work in the secondary schools secured their training in these college classes designed fundamentally for the future research worker, they tended to teach and to select curriculum materials focused in the same channel of "logical organization" without reference to meaning in the lives of young people and society. This tended to freeze content and organization into a precise pattern which teachers and textbook writers seem to think of as defining and delimiting the possible science offerings for the secondary school. Of course, as new data became available—and after a tremendous time lapse—they were sometimes added to the high school textbooks and school offerings. But this tended to follow the slow inclusion of the same materials in basic college classes in which authors and teachers secured their training, or else they were inserted to "enrich" or to motivate the students to study their "fundamentals" more rigorously.

It should be clear that the field covering approach does not, and really *cannot*, cover any field of science. At best it was a sampling made many years ago and is largely accepted in modern science teaching with no critical evaluation whatsoever by the majority of present-day teachers and writers.

The Generalizations Approach. The generalizations approach to science curriculum construction, presented in the *Thirty-first Yearbook of the National Society for the Study of Education*, was a reaction against the sterility of the field covering approach in practice. Research and experience had shown that the field covering approach resulted primarily in encyclopedic learning of discrete facts that were

often meaningless and unrelated in the student's mind and generally retained only long enough for verbalistic employment in the artificial hurdles of examination. It was believed highly doubtful that it was even the best method of providing basic training for the relatively few who might be expected to do research in some phase of science.

The generalizations approach is an attempt to arrive at the determination of major generalizations or "big ideas" that have influenced or are capable of significantly altering men's thinking and acting. Content and experiences are then selected to provide a meaningful and supporting framework for the generalization.

This approach, if it were adopted, would represent a major advance in curriculum construction. For one thing it would force a re-evaluation of science offerings in terms of significant major laws and concepts. Furthermore it would mean that the single criterion of basic training as preparation for ultimate research work in the area would be abandoned in favor of criteria of human significance. Theoretically it would mean that important and established major scientific truths would be adduced and science content would be organized so as to provide experiences leading inductively to the acceptance of the generalizations. If this inductive approach were rigorously followed in practice, facts which had been discrete and apparently unrelated in the field covering approach would be tied together as meaningful confacts and directed developmentally toward increasing the student's appreciation of major natural phenomena.

Up to the present, however, this approach has seldom been really tried. It has been too easy for textbook writers and teachers to raise the banner of a generalizations approach and then to continue with the same method and content formerly used, pausing only long enough to reshuffle and dump unassorted facts in a disorderly heap around each major generalization they were purporting to teach.

Even when an intellectually honest attempt has been made to develop science curricula by the generalizations approach, serious inadequacies have become apparent. This is due, I believe, to a weakness inherent in the method. Basically the generalizations approach is still a circumambulation around the criteria of human significance from which the generalizations are presumably drawn. Too many pitfalls lie in the path that must be walked in building a curriculum to support a generalization. The generalizations posited in the *Thirty-first Yearbook of the National Society for the Study of Education* were verbalisms of natural laws and phenomena, with little documentation or support to show their actual worth to young people or society. Most of them can be supported, but that task was left to the teacher or curriculum worker.

Consequently, most teachers got lost with the generalizations, and never found their way to the problems and concerns which were supposedly the core from which the generalizations drew their meaning and educational

value. Thus ignoring the prime factor of human worth, and accepting the ready-made generalizations presented in the Yearbook as *the* generalizations (which the Yearbook committee never intended), a considerable number of science teachers began to teach these laws and principles as ends in themselves.

Whether or not this practice could be defended on the basis that the laws had educational worth, it must be considered as psychologically blind. For even the scientist does not learn laws and generalizations in the abstract. Nor does he attack a generalization directly. He encounters a problem that is challenging and real to him. In the process of scientific analysis he arrives at certain tentative conclusions. As he works on other problems of a similar nature or containing similar elements, he finds the same factors operating and similar conclusions are perforce reached. Ultimately he has experienced a phenomenon in a sufficient range of situations that he feels safe in stating a generalization or principle that apparently holds true under certain specified conditions. Here, then, is the origin of a generalization. It grew out of a practical, or at least a real and non-academic, problem that appealed to an individual or a group emotionally and intellectually as worthy of investigation. Once the generalization was adduced it had value, not in and of itself but because it could be turned to the problems out of which it grew and to similar problems with predictive and controlling value.

I do not imply that learning must be undirected and delayed until fortune permits a student to attack problems in which the generalization operates. But I do assert that teachers generally have failed to understand the real significance of the generalizations approach. A psychologically sound approach to the understanding of a generalization must start with a problem that the student will accept and must lead inductively to the generalization if it is to have more than verbalistic meaning to the student. Science is of value because it gives us power to predict and control. Generalizations are merely reins in our hands by which we may more expeditiously and surely tackle problems and situations with assurance of predictive and controlling power. The steam engine, for example, coming into use in industry and transportation about 1830, initiated the Industrial Revolution and set in motion forces that are shaping the world in which we live today.

The Needs or Functional Area. This leads us directly to a consideration of the "needs" or "functional area" approach to curriculum development in science, for this approach is a logical outgrowth of the generalizations approach and is basically an insistence that the criteria for the selection and organization of content and learning experiences are to be found in the problems and situations with which young people must, or will choose to, deal. It considers generalizations not at the top of the pile of educational significance but as useful knowledge-tools with which to resolve problems of meaning. It accepts science, moreover,

as a way of thinking and acting, a procedure, and a philosophy of life as well as an organized body of knowledge discovered and validated by that procedure and accepted because the philosophy admits of pragmatic proof rather than of authoritative dicta.

But before considering this approach, let us examine what science teachers believe their responsibility to be and what adjustments are being asked of science teaching to meet wartime needs. For if we can discover important gaps between what is being taught by the prevalent field covering and generalizations approaches and what is defended as desirable by science teachers and by evidence of wartime needs, and if we can assign reasons for such discrepancies, we can better determine the comparative validity of the needs approach to science education as against the two approaches thus far discussed.

THE SCIENCE TEACHER'S RESPONSIBILITY

What Did Science Teachers Conceive Their Responsiblity to Be in Peacetime? In 1940 the writer, with the cooperation of the Research Division of the National Education Association, conducted a study for the National Committee on Science Teaching, of the opinions of science teachers throughout the United States on their responsiblity to young people and society.[1]

The following points are of particular interest for our present consideration. (1) A large majority (more than 80 per cent on each specific question asked) expressed the belief that a major responsibility lay in facing the problems and interests of young people and society and in bringing their specialized ability and their subject to bear on these problems and interests. (2) In spite of this professed belief, the teachers of science were avoiding for the most part a number of controversial areas in their teaching which represented important concerns of young people and society. They were avoiding these issues which they believed to be of value in part *because of insufficient knowledge to handle such issues adequately*. (3) The teachers were asked to express their opinions concerning a number of issues selected by experts in the field of anthropology, philosophy, sociology, and science education as significant areas of human concern at least partly amenable to scientific treatment or on which certain scientifically determined data were available. Significantly, the responses indicated that it had apparently made little or no difference in regard to their opinion on these issues whether the teachers of science had had their major work in biological science, physical science, or non-science. (The one exception was evolution. Majors in biology gave significantly different opinions on evolution from those given by the non-biology majors.) It made little difference whether these teachers had taken certain other specified courses, although some of the issues must be considered crucially important or basic to democratic living and properly within the province of

[1] Abstracted in an article in the TEACHERS COLLEGE RECORD for May, 1941.

one or more of these disciplines. Either these courses and areas have paid no attention to these issues, or their effect on the opinions of science teachers has been negligible. Little wonder, then, that the hand-me-down field covering approach still remains the epitome of science teaching. Little wonder that teachers of science feel unequipped to handle issues they believe to be important with immature youngsters and in communities where pressures might arise. The science teacher has been subject to education which has ignored, for the most part, training which would enable him to implement the function he believes is his in a democratic society. His training, the books and other curriculum materials he uses, the standardized examinations he gives, and the college entrance requirements a small number of his students face, all force his teaching into a mold. The inertia of tradition has placed heavy impediments in the way of really significant science teaching. With this in mind let us briefly examine what adjustments the war is demanding of teachers so trained and so equipped.

Planks from a Wartime Platform for Science Teaching. What do the science teachers think about their wartime responsibility? Are they complacent about their offerings? The following statements, excerpted from resolutions adopted by leaders from eight organizations of American science teachers, and eventually to be published in professional journals for consideration and ratification by their memberships should help to answer the questions:

"The present problems of science teaching are sufficiently important and urgent to merit the concerted attention of all leaders among science teachers."

"The science teacher's responsibility [in the war] is exceptionally heavy. First, he recognizes the importance of his field in the successful prosecution of this technological war, for he realizes that the training he provides in essential fields may ultimately play a large part in winning the war. Second, the science teacher is increasingly accepting responsibility in helping to provide an informed public opinion on the problems leading up to the war and the task of advancing the causes of freedom and security in the postwar world."

"The successful attack by science teaching on the many persistent personal problems faced by young people and the social problems amenable to scientific treatment depends upon the critical analysis and leadership given by science teachers. This analysis and leadership must immediately be increased."

". . . It is assumed that many areas to which science education can contribute with peculiar effectiveness have not been attacked by science teachers with sufficient directness. Among these are problems of health, conservation, accident prevention, production and distribution for the needs of a democratic people, support of research, consumer education, and cooperation with other cultural groups for world stability."

Apparently the science teacher is not serenely basking in the spotlight that this technological war has focused upon science education. Apparently the peacetime desire of science teachers to provide more functional instruction to young people has been accentuated by the needs of war. The difficulty of developing meaningful science curricula lies not in lack of

teacher concern, but in the tremendous weight of traditional training and practice, and in the lack of a clearly conceived method of approach to a sounder offering. War, during which youth must use their learning to save their lives and to win our battles, demands a functional approach to the science offering.

The following—a third curriculum approach—is suggested, therefore, as a method of pre-planning that should lessen the difficulties of actual functional teaching and provide optimum insurance that science teaching will actually function in meeting personal-social wartime or peacetime needs.

A Method of Pre-Planning Science Content and Experiences to Insure that Needs Are Met through Functional Teaching. The first, and a most necessary step in the needs approach in curriculum development is to retire from one's field in so far as possible for a time in an attempt to discover those problems or areas of significance, or those persistent interests of young people that may seem worthy of educational treatment. It is important for the teacher or curriculum worker to search for such areas with the eyes of a responsible citizen and leader of youth rather than through the eyes of a subject matter specialist. For if we start with our subject matter and then ask to what needs, problems, and interests it may contribute, we automatically narrow our field of vision and circumscribe areas of human concern by the limitations of our technical background and experience. True, we must ultimately return to our field and search it for contributions, but let us start with human beings, their problems and concerns. Youth and needs studies, community analysis, stated problems of community, regional, and national organizations concerned with every aspect of human affairs should be explored critically for clarification of areas of importance.

The second step, once areas of human need and concern have been determined and carefully considered, is to set up objectives within the areas and analyze the processes and content of science to determine those objectives that are possible of attainment through science teaching. Such objectives should be honest and real in that they arise directly out of real life problems or situations. These may be felt personal needs of young people, including interests in the world about them. They may be needs that are "predicated" or suggested as real by more mature persons with wider perspectives, for example, specifics of a consistent, workable, and personally satisfying philosophy of living. They may be found in social conditions that need bettering and may take the form of knowledge, attitudes, and skills desirable for democratic action on such conditions.

Third, it is not enough to indicate broad goals that seem worthy of attainment. One of the most venerable, most stressed, and least attained goals in science teaching is "to develop scientific mindedness." This "objective" has rarely been attained, partly because in this form it is unattainable and cannot properly be thought of as an objective

but rather as an area of predicated need in which objectives may be found. Certainly the goal of developing critical and incisive thinking and the ability to work successfully on personal problems is worthy of attainment. But this area of need must be broken down and stated ultimately in operational terms that give keys to their method of attainment. Otherwise they remain lip-service objectives and are generally forgotten in favor of content objectives which can be taught for and attained.

Note the following tentative analysis of this area of need into objectives.

We may state without fear of contradiction that it is desirable that young people develop scientific or critical attitudes and abilities.

Possible objectives that, if realized, may contribute to the meeting of this need are:

1. Ability to discover problem situations.
2. Ability to delimit problems into workable and procedural proportions.
3. Ability to develop critical hypotheses.
4. Ability to secure expeditiously relevant, authoritative reference data.
5. Ability to secure experimental or observational data critically and expeditiously.
6. Recognition of bases of authority in any field.
7. Ability to work cooperatively.
8. Ability to recognize personal bias and to consider it in making judgments.
9. Disposition to allow ascertainable facts to speak louder than prejudice.
10. Ability to communicate effectively and accurately.
11. Recognition of limitations of both data and conclusions.
12. Willingness to re-open issues if new data are available.
13. Recognition of approximate nature of truth.
14. An explicit understanding of major aspects of "the scientific method."
15. Recognition of applicability of scientific methods to many non-science problems.
16. Recognition of essential synonymity of scientific and democratic procedures.
17. Recognition of necessity for planning on complex issues.
18. Recognition of universality of cause and effect relationships.
19. Aggressive interest and ability in determining causation even in complex and controversial fields.
20. Critical understanding of differences in several historical and contemporary conceptions of truth and methods of formal inquiry: scientific method, magic, supernaturalism, reason, observation, experimentation in discrete areas, trial and error discovery, scientific planning, and pragmatism.
21. Faith and allegiance to the scientific method as against narrow, piecemeal understandings of it or awe-inspiring, glamorous, "almost magical" conceptions of science and professional scientists.
22. Recognition of limitations of scientific methods particularly when applied to areas where control is difficult and where contingencies and imponderables are numerous.
23. Understanding that although science may determine which of alternative defined goods or bads are most conducive to the outcomes specified in the definitions, science itself cannot determine what is good and what is bad. Recognition that the pragmatism of science is a method and a philosophy but that moral codes depend upon ethical considerations that are, in part, of a different order from science.

We will doubtless disagree on the inclusions in the above list of suggested objectives and omissions from it. The point is we now have specifically determined objectives which we can accept and teach, or reject, whereas if we merely stated that we wanted to develop scientific mindedness we would have no basis for curriculum construction or for teaching.

Fourth, it is useful to separate "pervasive" objectives from "general content" objectives and "specific" objectives. Pervasive objectives are those which are real and important enough (the list above states pervasive objectives) but which, generally speaking, are not best taught as a unit or area of focus but must be considered pervasively throughout curriculum construction and teaching. Understanding of these objectives may occasionally involve focal treatment, it is true, but generally they are concerns which, if recognized and taught for, permeate many or all aspects of the work. For example, cause and effect relationships should be understood emotionally and intellectually by every citizen in a democracy as applying universally from the falling of a stone to a global war. Naturally we would not consider our work done if we discussed only the universality of cause and effect relationships. Every unit of work, every item of consideration can be directed in such a way as to cause the learner to experience the fact that all phenomena are casually determined. Through repeated experiences the learner may come to look upon cause and effect relationships as applying universally. He has thus arrived at a generalization of great significance. He did not "learn" it by discussing it so much as he arrived at its explicit recognition through repeated and faceted experiences in which he saw causation operating.

Fifth, the nature of general content objectives may be considered synonymous with that of the major generalizations previously discussed. Note this important point, however: generalizations are here considered as important for objectives only as they arise definitely out of problems, situations, needs, and interests of young people and society. This is the same check on validity as proposed by the Thirty-First Yearbook Committee. If generalizations are so considered it will be clear that they are to be developed within problem or need situations and that their elements will appear in situation after situation until the repeated, though faceted, experiences will inductively draw the learner to the place where he accepts the generalization because it applies to many problem situations and will probably aid him in probing future problems that he will encounter. For example, the knowledge that communicable diseases are caused by microorganisms may be considered a generalization or general content objective. It is important and probably will only be learned (other than in a verbalistic sense) as young people see that the problems of keeping healthy and avoiding disease, which they accept as meaningful, demand for resolution some understanding of how diseases

are caused. General content objectives are of use, not to be taught for directly, but to delimit more specifically an area of human need (health in this case) in which specific and operational objectives can be determined.

Sixth, specific content objectives can be deduced logically from general objectives. Moreover they can be placed according to maturity levels of students and are operational in tone. For example, under the general objective of developing the knowledge that communicable diseases are caused by microorganisms might be placed such specific objectives as the development of the knowledge that a small rot spot on an apple spreads, that if it touches another apple the rot will be communicated to the sound apple, that the rot is communicated more quickly if the skin of the sound apple is broken, and so on. Obviously these are objectives for elementary school youngsters, but they may contribute to a developing conception of contagion which may lead to a rich understanding of the generalization above, which in turn may contribute to better health for the child. You will note that specific objectives imply possible content, activities, and general teaching procedures which may be conducive to the development of the objective.

It is believed by the writer that this ordering of curriculum work from area of need through pervasive, general content, and specific objectives to content and activities is an effective method of gearing the actual teaching definitely to the needs and interests of young people and society. Working backwards it will be seen that activities are developed and provided for in teaching which will aid young people in the attainment of specific objectives (skills, knowledge, attitudes) which lead toward the realization of general objectives, which in turn may culminate in the successful meeting of felt, predicated, and social needs. This preplanning does not stereotype teaching. It is not a teaching unit or even a resource unit, but in the opinion of the writer it should precede the construction of either. It is a master plan to avoid the large danger of doing sterile work in science teaching. The work of preparing such a master plan for writing or teaching is tedious but is richly rewarding in assurance of significant teaching. It is an obvious technic but its employment is long overdue.

The Teacher of Science and His Community

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A basic problem in science education is how to relate science to human affairs. It is basic because, unless science is related to human affairs, it is not likely to function in the lives of the students except in a narrow vocational sense. It is basic also because of the importance of science in a program of general education whose aim is to equip individuals to function effectively in the various areas of living. The rapidly approaching climax of the complete industrialization of society further underlines the importance of science in human affairs, and underlines the need for bringing about a closer relationship between science education and modern life. That much of the science education, especially with reference to scientific method, has proved sterile is owing in no small measure to the failure to bring about this relationship.

Science education can and should be related to life and living through developing understandings based upon accurate knowledge and in a *community context*. The critical requirement is "community context." Science teaching has always emphasized knowledge and more recently understanding. Too often, however, knowledge was isolated from life because it tended to be isolated from action. Understanding was then difficult to develop. The missing link in the progress toward functional knowledge, i.e., understanding, was invariably the community context.

This concept of community context is not new. Horace Mann years ago raised the question of the efficacy of educating students only in reference to themselves and to their private interests, at the same time neglecting the great social duties and prerogatives that await them in adult life. Kilpatrick has held for many years that the best unit of educative experience is some cooperative community enterprise where young and old work together.[1] More recently, the Bureau of Educational Research in Science at Teachers College has been attempting to implement the concept of a community context in education through a number of research studies in which teachers in cooperating schools have had a part. Add to this the more or less freelance work of many schools interested in this problem and it can be seen that

[1] Kilpatrick, W. H. "Social Philosophy of Progressive Education." *Progressive Education*, October, 1934.

no school or teacher need feel a lack of precedent when attempting to work out educational procedures which will relate education more closely to the lives of the students.

THE RESPONSIBILITY OF THE SCIENCE TEACHER IN THE COMMUNITY

A peculiar notion has persisted in American life that the school, although in the community, was not a part of it, and that the teacher was some inexplicable mutation of *Homo sapiens*. This phenomenon is understandable when viewed in historical perspective, and during an earlier period in our national life was of little social importance. Today, however, the continued separation of school and teacher from the community may well prove disastrous. What is needed to overcome this separation is appropriate action on the part of the teacher and the school based on the conviction that education is a living experience related to and integrated with the life of the community.

The first and perhaps the most important step that the science teacher should take in order to help bridge the gap between school and life is to assume actively the rights, duties, and privileges of a citizen of the community in which he teaches. This means living in the community, sharing its life and its problems, and working cooperatively with others for the improvement of the general welfare. The science teacher needs to realize that as a citizen he is as responsible for the general welfare of the community as any other citizen. Indeed, it is fair to say that he is more than equally responsible. The science teacher has certain competences as an educator and as a person trained in science which should make it possible for him to provide the leadership needed in the solution of many community problems. And it is by this kind of leadership and participation that the science teacher can make a major contribution to the closer integration of school and community.

The second and no less important step for the science teacher is to do everything possible to help the school to focus on community problems. This requires an assumption of educational leadership within the school interrelated and, as far as possible, integrated with the teacher's competence as a citizen and as a leader in the community. The most obvious beginning is with the students and teachers with whom the science teacher works most closely. Much can be done in this area as will be indicated later, but there should be also gradual but steady progress made toward influencing the total program and life of the school. To do less may in time endanger progress in the more limited situation where the science teacher has specific responsibilities.

SUGGESTIONS FOR PLANNING COMMUNITY STUDIES

Today American communities everywhere are challenged by unprecedented responsibilities and opportunities to restate their objectives and redefine their problems. Many communities have accepted this challenge

and are attempting to solve their most pressing problems not only in terms of the war effort but also in terms of the postwar period as well. The function of the school in this situation is plain. It should become a community center helping the community to define its problems and objectives and participating in the organization of community action directed toward the solution of problems and the achievement of objectives. This implies that much of the curriculum should be organized around the solving of problems—local, national, international.

Many of the learning situations in science education can and should be organized around community problems. This is especially important with reference to general education. (The special sciences pose a somewhat different problem.) Many teachers of science have already made progress in this direction. Certain suggestions concerning the planning of community studies can be made on the basis of their experience and the experience of other teachers. The suggestions that follow are indicative of what a community-minded science teacher can do and how he can plan to get it done.

Approach—Period of Orientation. The science teacher can approach the study of community problems in a number of ways. One approach which has proved successful in some situations is to ask the group to respond to questions such as the following: What do you like best about your community? What do you like least about your community? In what ways do you think that your community contributes to your welfare? What community problems do you know of that you would like to do something about? Do you think that you will be able to get a job in your community? Would you like to raise your family in the community in which you live? Do you think that science can help in the solution of community problems?

The group discussions of the responses to these and similar questions should reveal many problems, many gaps in knowledge, a considerable number of misconceptions and not a few prejudices. These should be carefully listed and recorded by each student in the group. As the list will be long, it will be necessary to arrange the various items in a more functional pattern for further analysis and study. The science teacher should take an active part in the discussions and group work, helping the students to see the essential relatedness of all community problems and watching carefully for the appearance of undue reluctance on the part of any student to discuss certain problems that he may be very sensitive about. The observations made while the students are taking stock of their community will prove helpful later when a more systematic analysis and study is made of the problems selected.

As an alternative, the teacher can disregard a general approach to community problems and begin directly with a specific problem such as health or housing. However, it cannot be too strongly emphasized that there is considerable merit in beginning the study with a consideration of the community

as a whole even though only one of the problems will be studied later. The interrelationships involved are very important and are part and parcel of the total situation. They are likely to be lost sight of unless the work is carefully planned to include them from the very beginning. Health, for example, is intimately related to problems of housing, recreation, nutrition, and work. It should not be isolated from these or other related problems. The way to avoid such isolation is to stress relationships continuously.

Selection of Specific Problems. The period of orientation will raise more problems than the group can handle in the time available. The decision as to what problem or problems will be analyzed and studied should be in so far as possible a group decision with the science teacher participating on the level of advisement and guidance. Matters pertaining to the mechanical details, to the purposes of the course, to the maturity of the group, and to individual and community interests and needs should be taken into consideration. Records should be kept for future reference.

Examination of Available Literature. Following the selection of the problem to be analyzed, some time should be devoted to a study and discussion of the literature related to the problem. A beginning can be made with the materials found in textbooks and other sources available in the school. Additions to these materials can be obtained from local, state, and federal agencies. A functional library should be begun and added to as the study progresses. Enough time should be devoted to this phase to enable the students to widen and deepen their orientation and to begin to crystallize their thinking around the problem on which they intend to work. The necessary guidance should be handled through group discussions and individual conferences.

Construction of Survey Techniques. The use of survey techniques will be essential if the study of the problem selected is to be carried out into the community. Before proceeding to this task, however, the group should make sure that they have the problem clearly in mind and that they have some comprehension of the purposes involved. They should be able to see the reasons for making the survey. Then questions should be formulated in such a way that the answers will give evidence about the postulated problem. For example, a group in a large city decided to make a study of the health problems in their community. Preliminary discussions revealed that they were interested in community sanitation, communicable diseases, and community health services. A list of questions was prepared for each of these problems to guide the analysis and study both in the classroom and in the community. Questions such as the following were raised with respect to community health services. A list of similar questions was prepared to guide the analysis of the problems of sanitation and communicable diseases. Does our community have a health department? What does the health department do? What does the head of the health department do? Are there nurs-

ing services in the community? Hospital facilities? Are there enough nurses, doctors, and hospitals? What effect have the health services had upon the health of the community? Do all people in the community have equal access to health services?

The survey device may be arranged in the form of a check list or in a form suitable for interviews or as a record form for recording systematic observations. In any case, the survey device should be carefully prepared by the teacher and the group.

Study of Published Data. When the questions or other survey devices have been formulated, the group should attempt to find out whether any of their questions have been answered. For example, a class working on the problem of energy resources of their community was able to get answers to some of their questions from the annual report of the local electric light and power company. Answers to other questions were obtained from census reports. It will be found that there are some published data on at least some phase of almost every community problem. A group making a community study will conserve time and energy by searching out and using available data. More time will then be available to study the community in relation to those aspects for which data do not exist.

Establishment of Working Relations with Appropriate Social Agencies and Other Groups in the Community. Before any field work is done, efforts should be made to gain the cooperation of those groups and individuals in the community who could be of most help in the study of the problem or problems selected. This should be begun as early as possible. For example, the group referred to above established cordial working relationships with the school doctor, the visiting nurse, and the health officer early in their planning for the study of community health services. The health officer sat in on one of their discussions and made many helpful suggestions concerning the construction of a questionnaire. No field work was done in this case until all community resources, including the school itself, were canvassed. Then arrangements were made to consult those individuals and agencies who could be of the most help. Each was informed of the purposes of the study before the consultation took place. This is an important step in establishing cordial relationships with officials and agencies to be used in the community study.

Field Work. Field work may be done on an individual or a group basis. If the study has been carefully planned, individuals or small groups of students can do some of the field work during after-school hours. The science teacher should be sure that each staff member as well as the administration of the school understands what his group is doing before taking the group out into the community during the school day. The effectiveness of the field work will depend in large measure upon the effectiveness of previous planning. Experience has shown that students who have not had much experience with field work need help in learning

how to learn in this kind of situation. What the field situation stresses, of course, is observation and the relation of observation to previous experience. The science teacher must make sure that each student is profiting from his experience and that he is acquiring the ability to learn in the field situation.

All arrangements for field work must be made well ahead of any visitation. This ordinarily will include such matters as time, place, transportation, and so on. If the field work involves visiting an industrial plant, a clinic, or any place where a process is to be observed, it may be desirable to arrange for a small group to make a preliminary visit in order that the planning for the group visit may be more effective.

Interpretation and Integration of Learning Experiences. Much of the work in the classroom and laboratory during the progress of the community study should be devoted to the interpretation of the data gathered and the acquisition of skills, information, and abilities needed in the understanding and solution of the community problem being analyzed. The teacher should make a serious effort to help each student to integrate these various experiences and to make them a functional part of his thinking and acting.

An example taken from the experience of a science teacher in a small suburban community may make this clear. This teacher proposed to his physics class that they make an analysis of the energy resources of their community in connection with their study of the transformation and control of energy. Following a period of exploration and analysis of the total problem, the group decided to begin with a study of the production and distribution of electrical energy in their community. A list of questions was developed after some discussion and reading of available materials. Visits to the community distribution center and the generating plant located in another community were made. An analysis of the flow of energy through the community was worked out in terms of electrical power. Laboratory work, discussions, and consultations with the electric light and power officials were devoted to building up understandings of the technical principles involved. Social implications were considered and studied in the light of the fact that the community owned and operated the distribution system, buying current from a near-by generating plant and reselling it to the residents at a profit which was later returned to them in the form of reduced taxes. State and national problems related to the generation and distribution of electrical energy and their importance to the local community were stressed. All these activities were so organized as to contribute directly to the development of the student's ability to deal more effectively with the problem of maintaining an adequate flow of energy in all communities.

TYPICAL COMMUNITY PROBLEMS

Every community offers opportunities for the study of its problems.

Many schools have recognized this fact and have attempted to organize some of their learning experiences around the problems in their communities. The list which follows is by no means inclusive but it does represent a sample of the problems science teachers in many communities have been using as organizing centers for some of their teaching.

Community Setting. Historical development of community changes that have taken place and why these changes have come about. The natural history of the community and surrounding region—geology, mineral resources, flora, fauna. Geographical location. Climate. Problems arising out of the natural setting.

Housing. Housing conditions—slums, "right side of the track." Materials used and available for construction. Zoning. Comfort in the home—air conditioning, insulation, labor-saving devices. Housing standards. Factors working for and against good housing. Social cost of bad housing. Needed technical reforms.

Health. Sanitation—water and sewage. Control of communicable diseases. Health services and practices in the community. Vital statistics—infant death rate, general death rates. The significance of vital statistics in community life. Problem of equal access to health services.

Nutrition. Relation to health. Community understanding of meaning of adequate nutrition. How to get adequate nutrition. Relation of nutritional problems to quality and quantity of available foods.

Group Relationships. Conflicts between racial and national groups. Problem of equal access of all groups to community opportunities and services. Genetics in relation to racial problems.

Energy and Material Resources. Location, quantity, quality, and rate of use. Development of resources—soil, water, power sites, ores. Conservation practices versus exploitation. Problems of ownership and control. Analysis of flow of energy and material resources through the community.

Capital Resources. Industrial establishments. Transportation and communication facilities. Technical competences.

OUTCOMES AND EVALUATION

Desired outcomes should be an outgrowth of the exploratory work done by the group with respect to the problems they are analyzing and studying. The teacher's experience should count heavily in this situation. The outcomes should be stated as clearly and specifically as possible, for they will later form the basis for evaluation. Although each teacher and his group will need to define their own objectives in terms of their own community, some general outcomes derived from the experiences of teachers who have worked on community problems can be stated.

1. An appreciation of the role of scientific procedures in the solution of community problems.
2. An appreciation of and an increased respect for the value of community resources and an interest in the wise use of these resources.
3. An appreciation and understanding of the essentiality of an objective approach to the solution of social problems.
4. The acquisition of functional knowledge and insight derived from active participation in the solution of community problems.
5. An increasing disposition on the part of the student to participate as a responsible person in community planning.
6. An appreciation of wealth in terms of goods and services derived from the use of material and energy resources.
7. An appreciation of the nature of our

industrial society based upon comprehensive knowledge and understanding.

8. The development of a perspective will enable the student to see his community as a part of a larger regional, national, or international community.

Evaluation should be considered as a part of the community study from the very beginning. It should be based on the recognized objectives and desired outcomes. Student changes with respect to certain objectives can be measured by means of paper and pencil tests. The nature of many objectives will require such evaluation techniques as anecdotal records and interviews. Students should be given opportunity to evaluate their own growth. This can be done through class discussions, individual conferences, and questionnaires. Students should also be given an opportunity of evaluating the procedure, materials, and learning experiences used in the study of community problems. Evaluation of students by means of observing what they do about the problems they have studied with respect to themselves and to the community can also be used effectively. In so far as possible the evaluation should be a continuous process, and not confined necessarily to periodic examination. When this is done effectively, modifications in procedure, materials, and in the learning situation can be made from time to time to meet the changing interests and needs of the students.

CONTROVERSIAL PROBLEMS

Any comprehensive analysis of community problems will sooner or later take the analyzer into the realm of controversy, because no analysis is worth the time and energy unless it leads to constructive action or suggestions for constructive action. It is in the realm of action that the controversy becomes most acute. The science teacher can best safeguard his interests and the interests of his school and community by making sure that his knowledge and understanding of the problems and issues involved are comprehensive and sound. Furthermore, his approach must be objective, as objectivity is an essential requisite for the rational solution of any community problem. At the risk of being obvious, it can be pointed out that one cannot successfully fight ignorance and prejudice with more ignorance and prejudice.

The science teacher must be sincere and honest and must understand the importance of human relations when dealing with controversial problems. He must learn to work with parents, fellow teachers, other citizens, social agencies, organized groups, and governmental officials. Finally, the science teacher must have faith in himself, faith in the objectivity of his approach, and faith in democratic procedures as a method of ultimately realizing community objectives.

Teaching Science and the Individual

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THE dictionary definitions of science as an organized body of subject matter, systematized and formulated as general laws, are of little help in determining how to teach science to the individual. The accumulation of systematized knowledge is so vast that no one individual could possibly encompass or use all of it. Different individuals have use for different portions of it, and their use depends upon many different factors. Perhaps outstanding among these factors is the way the individual acquires his or her understanding of the principle or principles concerned.

THE USE OF SCIENCE

If we look upon science as a means of finding out, of making decisions, of determining what to do, then we can gain an idea of how to use science by observing how experts use it in the fields in which they are skilled.

Consider the way the doctor works when he is called to treat a case of appendicitis. He queries the patient concerning aches, pains, and soreness, the duration of these symptoms and their intensity. Then he gathers more information by checking on temperature and pulse. All the time he is comparing the symptoms of the patient with those of other patients he has known, in order to diagnose the nature of the ailment. If all the symptoms indicate appendicitis, he may have the patient sent to a hospital. Here laboratory blood tests will be made to verify the diagnosis and to determine the gravity of the situation. If the blood count is high, the patient will be operated upon immediately. Throughout the operation, techniques and procedures based upon scientific findings will be used, and the chances are very high that the patient will recover.

Much of the information and knowledge which the doctor uses has been gleaned from years of experience with this and other kinds of illnesses, and much from his understanding of anatomy and physiological processes. (He will not turn to scientific literature in this instance, but would if the symptoms proved those of a rare disease.) Many of the procedures, in fact most of them, will have been reduced to empirical rules and applied with the positive conviction that they will work; that is, the doctor can rely on the instruments and bandages being sterile if they have been in an autoclave for a given number of minutes at a given number of pounds of steam pressure. Sterilization is always done this

way, and the instruments and bandages are always sterile. But this procedure is based upon scientifically conducted laboratory tests in which it has been found that heating objects at this temperature for this duration of time renders them sterile.

SCIENCE OR COMMON SENSE?

Or think of the way a farmer makes his decisions in growing a crop of corn. Before deciding to plant corn, he must consider numerous economic questions, which he may face scientifically, such as the prospective market value of the crop, the livestock he has on the farm, the cost of labor and of fertilizer, the machinery available, the erosion cost, and the like, but we shall disregard these for a closer scrutiny of the problems involved in raising the crop of corn. In the first place, the land must be prepared. Before preparing the seed bed, the farmer must wait until the land is dry enough to work without spoiling its structure and until the machinery can be used without bogging down. He must plan to work the land, however, before it becomes too dry. Furthermore, to get a good crop of corn he must plant the seed as soon as possible after weather conditions are right or the crop may not mature before frost. There are numerous other problems connected with the preparation of the seed bed, such as how deep to plow, how to plow to cover completely the green manure crop, whether to plow on the contour or in straight rows, how to fit the soil after plowing, how loose to keep it, how much to pulverize it, whether or not to add fertilizer, how deep to plant the corn, how close together to make the rows, what seed to plant, and so on. After the crop is planted there is a continuous succession of problems that have to do with preventing the weeds growing and encouraging the corn to grow. And if the farmer is reasonably successful in solving these numerous problems, and if unforeseen catastrophes do not occur, he will have a good crop at harvest time.

But is the farmer being scientific in his procedures? Perhaps he is just following rule-of-thumb methods. Perhaps he is raising corn as his father and grandfather raised it. Perhaps he is just using plain common sense.

True, the scientific method and the common-sense method are very much alike, and in many cases it would be difficult to determine whether the farmer was being scientific or just being sensible. The difference lies in whether or not the farmer-thinker is continuously examining the assumptions underlying his procedures to see if they are sound and investigating evidence of the success of new ways of doing things. To what extent are the procedures based upon scientifically tested knowledge? The wisdom gained over years of experience with successes and failures as to the time to plant corn is scientific as truly as published reports from experiment stations concerning the time to plant.

A third case may be helpful in clarifying the issues. Let us see how a mechanic checks a car which will not "start." Knowing the scientific principles involved in the operation of any

internal combustion engine, he quickly and somewhat superficially tests to locate the trouble. Is the battery "dead"? A push on the starter lever reveals plenty of "juice." Is there spark in the cylinders? A quick check of a spark plug tells whether or not it is firing. If it is firing, then the trouble must be in the fuel supply. Is there gasoline? Does the gasoline reach the carburetor? Is the mixture right, or is it too lean or too rich? And so he checks item after item, selecting first what are to him the most likely causes of the difficulty, and continuing until the specific trouble is located.

Again, this is the common-sense approach to the problem. In addition, it is the scientific approach. In this approach every resource of the mechanic is brought to bear upon the problem at hand, and much of the information consists of tested scientific data which the mechanic uses in a more or less routine fashion. At times his information may not be complete and he may have to consult standard reference works, especially if the model of the car is an unusual one with which he is not familiar. But no matter how unusual the car, the mechanic understands the basic principles of its operation and refers to them again and again.

APPLICATION OF SCIENCE IN MANY AREAS

If we examine the everyday work of hundreds—yes, even thousands—of different specialists, we shall find the scientific method in use. Furthermore, these specialists will be making use of tools and devices which in themselves represent scientific developments. Many of the jobs along the assembly line are mere routine repetition of a limited number of specific tasks, but the problem of laying out an assembly line for efficient production of goods cannot be solved adequately by any method other than the scientific one.

So successful has been our application of science and scientific methods of thinking to material matters that we are depending upon these methods more and more to answer our social, political, economic, and even our religious problems. In fact, our use of democratic methods in dealing with our political and social issues is an application of the scientific method. We use democratic processes to determine a course of action. In the laboratory, we use the scientific method to find the answer to something we do not know. In the democratic process, we use scientific procedures to judge the relative merits of this or that course of action. Decisions are made in terms of the probable consequences to the individuals concerned rather than in terms of the truth or falsity of a statement, or in terms of whether or not a given step works in the synthesis of a new chemical.

A good example of the application of science to the solution of a difficult socio-economic problem is the Tennessee Valley Authority. This Authority, created primarily to cope with floods, investigated related problems as well, and in the light of the findings planned and executed an inclusive conservation program designed

to improve the welfare of the millions of inhabitants in the region in the most efficient and economical way. Unless science can operate in these broad, significant areas as well as in the development of instruments, tools, products, and the like, we shall continue to live in a world of chaos. How can science be taught to the individual in such a way that he will use it in solving the everyday problems he encounters, and in meeting the major problems of democratic living as well as we have taught him to use it in the laboratory or in connection with technical works of various sorts?

THE SCIENTIFIC APPROACH IN THE CLASSROOM

In the first place, the teacher must be conscious of his function as it relates to his students. He guides the class group, not just because he has been appointed to teach them, but because of his greater experience, ability, and understanding. He guides the group to think and act scientifically until the classroom becomes a place where teacher and students plan and administer the program jointly. The curriculum becomes an emerging one, adjusted by the cooperative group efforts to the particular interests and needs of the individuals in the group. These include purposing, planning, sharing, executing, appraising, modifying procedures in the light of successes and failures, researching, re-appraising, and so on. The curriculum takes its direction from the democratic interaction of ideas, judged in terms of their value or merit to the group who are learning.

The teacher's experience and judgment are of greatest importance in raising questions which reveal strengths and inadequacies. Are the data from which the conclusions are being drawn adequate? Are the data valid? What are their limitations? What assumptions underlie them? What motives? If the conclusions are sound in this case, can they always be depended upon? And if they are true, what difference should they make in one's thinking and acting? How do these conclusions check with others related to them? Are they consistent with the experience of the group? With the literature on the subject? With the theories and findings of great scientists?

Whenever data are collected for use in determining action, the consequences, or probable consequences, of such proposed action are a necessary part of the process. There are time consequences as well as directional ones. If we follow one course of action, then we cannot follow another course which is almost as attractive, for there is not time for both—all action decisions must be made in relation to the numerous and diverse factors related to it. In our daily lives choices must be made continuously, and the scientific approach to making decisions takes into account their relation to other desirable courses of action. To the extent that the relative merits of the alternative courses of action are evaluated or judged adequately the proposed course of action will prove wise. To the extent that readily available information is used the data will prove valid.

Probably the outstanding way that a teacher can find out about the individual student and guide and direct him is through questions asked in group discussions. These questions should reveal strengths or weaknesses of the positions or conclusions held by the group or by individuals in the group. By listening to what a student says, a teacher can tell whether or not he understands the principles involved in what he is saying or doing. By asking searching questions and listening to the student's responses to these, a teacher can appraise the student's position and evaluate his growth.

Paper and pencil tests, made to evaluate a student's mastery of selected principles, or the application of these principles in meeting new situations are of some help, but they seldom reveal anything about how the student learned the principle or anything about the depth of his understanding of the principle. He may have memorized it without any conception at all of its meaning. He may even have memorized a kind of application of this principle to a situation, and have recognized in the test situation elements which make it possible for him to apply the principle correctly without any adequate understanding of it. There is no substitute for the informal discussion group in which students and teacher interact. Such a discussion reveals the extent to which science is being lived and applied. And without knowing the weaknesses or fallacies in the thinking of his students, a teacher has little chance to help them learn to think more scientifically.

Boys and girls can be taught to do all kinds of things by various means without thinking or without using a scientific approach. But anything other than a scientific approach is a weak substitute for the kind of education we need to help boys and girls think and plan and act to build a better world out of the one we pass on to them. The scientific method applies to all kinds of situations, whether in connection with the synthesis of some new product, in the nurture of an organism, or in planning for a better society.

LEARNING A MODIFICATION OF THE INDIVIDUAL

Learning occurs whenever an individual has any kind of experience. Everything that happens to the individual makes him different from the way he was before. Learning is a modification of the individual in which he gains new insights and meanings, which do not come from the addition of something to the organism, but from the integration of the new experience with the memory of others which the individual has had. This modification of the old into new and more mature understandings is the essence of all learning. And each new unity of understanding furnishes a broader and higher threshold from which new and more distant vistas can be seen. Learning is an organic, emerging process. We can provide for the most efficient learning in our schools by so arranging the situation that the curriculum emerges as a result of the intelligent interaction of teachers and students.

The Modern Role of Biology Teaching

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THE teacher of biology stands face to face with an unequalled opportunity to serve society. His difficulties in finding for biology a legitimate place in the educational scheme have in part been removed, and for the past decade or so he has felt free to draw breath and deal with the problem of determining guiding principles, aims and objectives, content and techniques, and procedures of evaluation. But any subject whose value depends on its contributions to the personal living of the individual, and which is, therefore, designed to produce desirable changes in the individuals who will contribute to the improvement of a changing community cannot maintain itself on a pabulum of static guiding principles, content and technique.

Bernal[1] and Powers[2] among others clearly conceived this role of science in a modern society. Translated specifically to encompass the field of biology, their ideas may be given expression in this way. The old biology, with a more or less rigid separation between it and the problems of society, cannot deal with social developments which require those biologic principles, knowledges, and attitudes which will provide the following:

1. A sufficient understanding of the human organism to enable those citizens who are not doctors, nurses, veterinarians, farmers, and other agents of public health or biological production to cooperate intelligently with those who are.

2. The opportunities for a practical understanding of biological method which will give the citizen the confidence to attempt the solution of problems which he has to face in his individual and social life.

It is not enough to present merely the opportunities to obtain such knowledges, attitudes, and skills; these outcomes of biologic education must become a part of the individual, must become an "operative content." Biology must not become a science in which an individual is exposed to a certain number of clock-hours of scientific facts, but these facts must be used. This "operative content" appears then to be a function of the use of biologic facts in contributing to the solution of the problems of the individual and the community. It is clear

[1] Bernal, J. D. "Science Teaching in General Education." *Science and Society*, p. 2, Winter, 1940.

[2] *See* the article by Professor Powers in this issue, pp. 234-40.

that first we must look to the promlems—then marshal the facts we need for their solution.

Biology teaching in the past provided specialized training far in excess of the needs of the children of the community. This type of teaching, however, dealt with a content which was often so unrelated to problems of living that it became, more often than not, useless and boring and impossible to remember. For those whose curiosity and ability to absorb facts unrelated to personal living are extensive, such courses may still be desirable. However, it seems absurd to require the majority of our students to learn the complete life histories of *Paramoecium*, *Rhizopus*, and *Spirogyra*, including the serious study of a type of sexual reproduction of these organisms, and to memorize the scientific vocabulary involved in the classification of plants and animals when the urgent and immediate problems of personal and community living—nutrition, disease, social behavior, racism, and biological production—beg for solution. Some teachers spent precious hours teaching the relationship of the radiating canals of *Paramoecium* to the vacuole. Elsewhere others were changing world history by teaching false doctrines of racial superiority. Ignored was the need for a better understanding of health or of the meaning of adequate biological production, underscored by dust bowls and the "Okies."

Now biology teachers can provide their students with the understandings and methods which are powerful means of eradicating ills that result either from ignorance or from failure to deal with problems which the method of science places at our disposal.

The problem and the scientific method which solves it complement each other. A problem will most readily motivate the desire for solution if it is meaningful and real, and it will also be useful in demonstrating scientific method. It seems reasonable that students will most readily appreciate scientific method in their lives if they use it to solve problems which are significant and real—problems of personal and community living.

It would be presumptuous for any single person to insist that he and only he has the all-seeing eye regarding problems of living. But the important thing is not whether all the problems are mentioned, but that important problems be listed. Furthermore, the precise way or the order in which these problems are stated is unimportant; it is important only that they be stated. Some of the problems will appear to deal primarily with areas in the social studies, or in physical education, and it may be that biology or hygiene or social studies teachers, jealous of the prerogatives of their subject, will prefer delimitation of subject areas. From the social point of view it is important only that these subjects be taught by teachers competent to teach them.

PROBLEMS OF LIVING

Simply stated, the problems of living to be taught are the eternal ones concerned with the better life. What must an individual do to lead a happy, productive life?

Obviously, he must do a number of things, many of them out of the realm of biology. But in all his activities he is first an animal—he eats, breathes, digests, eliminates wastes—in brief, the problems of metabolism are his. So we may state one problem whose solution depends to a great extent upon the biology teacher, namely:

The problem of contributing to the well-being of the individual.

In the past years, the evidence has indicated that the problem of contributing to individual welfare was not satisfactorily solved by the community. The data on rejections in the armed forces have shown the prevalence of common ailments, some of which could have been eradicated through good health practices. They provide evidence of malnutrition in certain areas, and the examination of the dietary habits of soldiers has shown a need for information on and inculcation of desirable practices in nutrition. The failure of some soldiers to understand the nature of transmission of certain diseases, such as typhoid, hookworm, syphilis, has indicated the need for instruction.

Modern biology must accept its responsibility, therefore, of giving the citizen the information he should have about the needs of his body in order to maintain its structure and function. Whether structure and function should be taught before need, or vice versa, is of little moment here. It may suffice to state that a realization of the need will serve as an intrinsic motivation for a study of structure and function.

The citizen of a modern community must know enough to understand his body's need for clean food, balanced in its protein, carbohydrate, fat, vitamin, and mineral content so that he will cooperate with his family and his community in establishing the practices which will yield him such a diet. Similarly, he should understand the need for proper physiologic practices and demand for himself and his community those practices which will give him and his children good housing, proper sanitary facilities, and playgrounds. He will want to know how to avoid the agents which would cause him pain, injury, or death; he should, therefore, have some information concerning the causes and prevention of diseases which will give him a clear insight into methods of preventing the entry of parasites.

Because health practices depend so much on proper habit formation, the biology teacher will need to help the citizen understand his own behavior. The ultimate goal in this work should not be a knowledge of the structure and function of the nervous system, but an understanding of the development of behavior (good and bad). As a result of this work, the citizen should have the understandings and practices necessary to improve those habits of learning, those habits relating to personal health, those practices relating to the more efficient regulation of personal living.

The work prior to this point has focused attention on the individual—the food he eats, the use he makes of it, his metabolism, his habits, his learning. But the individual cannot have his

little corner; he is part of a community of individuals like him in the gross needs of their bodies but unlike him in countless aspects. The individual is a community of cells each working for the common good; the effect of the malfunction of any group of cells is known to us. Society has been likened to an organism composed of a community of individuals; the effect of the malfunction of any group of individuals, or any single individual, cannot help affecting the organism.

The work on behavior leads to the second major problem which the biology teacher faces, namely:

The problem of contributing to the well-being of the community.

It is immediately clear that the problem of the health of the individual is a community problem and that the problems dealt with heretofore could easily have been discussed under this heading. But if biology places itself clearly in the service of the individual and the community, then, through either one, the other is well served.

Because the citizen is a member of a community, the biology teacher will be forced to go into the behavior patterns which underlie cooperation. So vital is the matter of sound human relationships that the biology teacher must lend his subject to their furtherance. It is important to discuss the tropisms of plants and the behavior of the goldfish only if they explain man's behavior. The criterion for the inclusion of such material might very well be this! Does the elimination of the material leave more time for teaching those understandings which immediately affect the students' behavior?

The acquisition of a basis for the understanding of sound habit formation is not enough; the behavior considered must be that which is part of the student's life. He should see himself in the light of development from a dependent animal to an animal with the responsibilities of citizenship, and the responsibility for his own future development.

One aspect of behavior which is a problem of personal as well as community life, which invites emphasis because of the peculiar prevailing taboos against its open discussion, is that of sex. Possibly there is no topic which presents the kind of difficulties offered by this one. The problem, however, is a real one in most communities and the biology teacher can contribute to its solution. With some youngsters the problem of masturbation is a real one; others want to know about "necking." The biology teacher must help to convince the community that if the problem does exist, it should be dealt with as a matter of common sense. It need not be dealt with in formal presentation in the classroom, but it may be solved by parents, by counselors, by the church, by community forums. The biology teacher is a member of the community in which he teaches; he cannot close his eyes to those problems which training and necessity place within his sphere. If the peculiar constitution of the community calls for unusual extra-classroom procedures, then he must lend himself to those methods.

It is conceivable that there are indi-

viduals who have sound health habits, study habits, habits of work, habits of play, who still cannot function at their best because of false notions of superiority—racial, social, or religious. The problem exists in all its terrible manifestations; not only do men deny others a livelihood because of race, but ostracize them or kill them because of race. Even our better newspapers are contaminated with confused notions of race, nationality, and religion. The biology teacher can at least teach the basic understandings of genetics and anthropology. He can give evidence to show that special vices and virtues are not the peculiar property of any one group. He can hold up the claims of purity and superiority of any given group for examination in light of the evidence. The citizen of a democracy must understand the culture and origins of his neighbor. As he relates these to his own basic origins, he will begin to see and emphasize the similarities and understand the differences.

But such evidence cannot clearly be comprehended, cannot become part of the individual unless he has a working knowledge of heredity. And so a knowledge of the laws of heredity becomes vital, for not only is it the basis of an understanding of the characteristics of peoples, but without it the citizen cannot truly understand himself and the real heritage he will give to his children. He should know enough of the inheritance of human traits to realize the part they play in making him what he is; he should be able roughly to assess the value of the gene and environment as they mold the individual, the family, and the community. And because he depends so much on biological production, he should know the part the gene and its environment play in producing the food he eats, the clothing he wears, the medicines which cure him, and some of the implements of the civilization which fosters him.

Modern biology must not fail to contribute the knowledges, attitudes, and skills which arise from the successful teaching of genetics. A knowledge of the characteristics inherited by man and their transmission requires a thorough study of the laws of heredity, the chromosome theory of inheritance, and the more recent understanding of the place of environment in conditioning the expression of the gene.

At the same time, there is some danger in permitting students to generalize too broadly from the study of the genetics of *Drosophila* and maize. We need to emphasize the point that the facts of human inheritance are meager and that the statistical technique is of very recent application. Too much misinformation has been gained from the studies of the Kallikaks, the Jukes, and the Edwards. We are not yet at the point where we can assess accurately the specific contributions of the gene and the environment to more than a few (some geneticists would not even agree with this) inherited traits of man. We can, however, with some accuracy consider the effect of temperature on the expression of the genes Bar and vestigial in the development of *Drosophila*.

The study of reproduction becomes

more meaningful against the background of genetics. But the physiology and anatomy of human reproduction should be taught. It is ridiculous to go deeply into the metabolism of the individual, his genetic constitution, and fail to give him an understanding of those activities of his body which reproduce the individual, shape the family, and continue the population line. The biology teacher is again mindful of the social taboo, but he must again realize his function. The information regarding proper sexual function, proper fetal development, must be given by some agency in the community; whether it be the teacher or another properly equipped agency is not important. It is his function as an expert in the field of living things to see to it that there are no misconceptions regarding the reproduction of that living thing which is most important to the community, e.g., the human. It is absurd to deal with the reproduction of the archegoniates and angiosperms, and the lower animal phyla and vertebrate classes, and stop short of the reproduction of the human. For the community is dependent upon the birth of individuals who can benefit from and contribute to its activities.

The concepts of heredity contribute to a clearer understanding of evolution and anthropology and will no doubt point out the nature of the successful mutation. The question of the relative importance of heredity and environment in the development of new forms and varieties becomes, however, an academic one.

From the teaching point of view, the effect of the gene on biologic production is extremely satisfying, for here the dependence of the community on the gene is easy to demonstrate. Furthermore, there is substantial agreement that those animals and plants which possess a genetic constitution which results in greater yield ought to be saved, the others destroyed.

The examples are legion. The stories of milk and butter fat production, of hardiness of the cereal grains, of resistance to disease of cattle and of food plants, of the development of new types through selective breeding are easy to understand. It is possible to demonstrate that the careful manipulation of genetic constitutions has resulted in such increased biologic production of basic foodstuffs that no individual need be without a satisfactory diet.

But again the effect of the gene cannot be separated from the effect of the environment on its expression. The biologic production of good hay and grass for the cow with the genes for high milk production must be kept at optimum. This, in turn, depends on the maintenance of the optimum biologic productivity of the soil. The uselessness of planting a tobacco plant with genes for three times the leaf area of the original species in soil which does not have the magnesium necessary for the production of chlorophyl, or of planting corn or wheat in soil robbed of its nutrients by poor agricultural practices, is obvious. The study of the maintenance of the biologic productivity of the soil is one of the most impor-

tant functions of the biology teacher. For our present civilization literally has its roots in the soil and depends on it for food and clothing, for building materials and medicines.

When the student has had the opportunity to work with the problems affecting his well-being and the well-being of his community, he recognizes the relationship of these factors to his life span. He realizes that a productive and happy life, and a long one, depends on the multiple factors which make up his heredity and the multiple factors which make up his environment. In this light he can evaluate such varied factors of eugenics and euthenics as disease, birth rate, immigration, housing, criminality, workmen's compensation, child labor laws, wage scales, and war. The student who is trained to understand the wonder of the human organism, who can understand the parental and community care which goes into realizing the complete expression of its genes, will realize the true criminal nature of war and will collaborate more intelligently, it is hoped, in steps toward its elimination.

Our modern biology course begins to shape itself. Underlying the course is a modern concept of biology—the organism is the product of his heredity and environment. It is a unifying concept. For the trends are clear—every animal, every plant, every human being appears to be a product of heredity and environment. And the responsibility is clear—every animal, every plant, every human being can be improved by improving either its heredity, or its environment, or both. Biology teaching has a unifying principle with social scope and a recognized universal application.[3]

It remains for the biology teacher to make this concept count in his teaching. If he does, he can be assured that he is a factor in world progress, that he is contributing to better living.

[3] Glass, in *Genes and the Man*, emphasizes this cornerstone of modern biology and develops it in its important ramifications.

The Modern Role of Physical Science Teaching

THEODORE D. BENJAMIN

INSTRUCTOR, BRONX HIGH SCHOOL OF SCIENCE, AND LECTURER IN NATURAL SCIENCES, TEACHERS COLLEGE

In any attempt to judge the effectiveness of physical science education we must seek to determine whether that education is adequate to meet the problems of modern life. We find that today many issues of a scientific nature which confront the individual are incompletely resolved because the individual lacks certain skills and information which could lead him to a solution. It is evident, then, that physical science teaching must re-evaluate its materials and set for itself the task of providing an adequate education for modern living.

Exactly what are the problems in modern living which the individual will face? If by some means we could know in advance what each of these problems would be, our job would indeed be easier. Unfortunately, the best we can do is to guess, or perhaps try to determine, what elements of the future life of the individual will probably be common to all. The responsibility for the determination of these elements rests with the alert, informed teacher. It is his duty to provide his students with the tools whereby they can successfully come to grips with a given problem and scientifically arrive at a solution.

We know, for example, that problems of health, nutrition, social adjustment, housing, religion, and leisure are sure to be part of one's living. We know, too, that all people are subjected to the same physical environment and that all desire and deserve to share in the progress which science has made in conditioning that environment. Furthermore, we know that these individuals are part of larger groups. Our students will eventually be called upon to participate actively in and share the responsibility for the growth of the social structures in which they find themselves.

These are but a few of the common elements and it is from a keen analysis of such elements as these that we must derive the role and content of the field of modern physical science teaching. In the past, we have done a fair job of determining the issues and meeting them squarely. However, the attitude of the scientist and the layman toward science and its implications has changed as a result of the events of the last decade. We must, therefore, re-

examine our objectives in the light of these changes, and modify the objectives accordingly. By and large, we shall find that it will not be a matter of changing, but rather that of shift in emphasis. The following is an analysis of some of these shifts in emphasis, particularly within the more important areas. These are the places where painstaking work must be done if we are to bring to full fruition the results of physical science teaching.

SCIENTIFIC THINKING

The basic approach to all problem solving lies in the ability to apply the method of science. Today, as never before, the average man is called upon to render judgment on an increasing number of issues in which the application of the principles governing reflective thinking will guarantee the greatest good for the greatest number. The objective of instilling an understanding and an appreciation of the importance of the scientific method can undoubtedly be achieved better in the science classroom than anywhere else. Unfortunately, however, it cannot be taught quite as easily as the factual information which can be vividly demonstrated and satisfactorily applied. The ability to reason scientifically must come as a concomitant of the application of the problem-solving process to actual situations. Once the characteristics of scientific thinking (1. recognition of the problem, 2. formulation of hypothesis, 3. collection of data, 4. modification and application of hypothesis) become evident, each successive application will help to build and strengthen habits of thinking which will last a lifetime.

There is no question but that the materials of physical science are admirably suited to the development of scientific thinking. But the greatest value of this problem-solving process lies in the fact that it applies not only to problems in science but to other fields as well. It applies, for example, to every judgment and decision the future citizen must make. Too often, however, we assume that ability to reason scientifically within the field of science will carry with it a similar ability in other areas.

The very foundation of the principle of political self-determination lies in the ability to think scientifically. Democracy's faith in this ability of the individual to gather reliable data and to use them effectively in reflective thought imposes a responsibility upon education to intensify the hold of the scientific habit of mind. In a converse sense, science itself contains the very essence of democracy, for scientific progress is possible only when a free and unhampered interchange of scientific ideas can flow across racial and political borders.

THE SOCIAL IMPLICATION OF SCIENTIFIC DISCOVERY

The invention of the cotton gin and the steam engine brought with it technical and social revolutions of great significance. The startling results of the social impact of these developments can surely be understood by the average high school student. Curiously enough, however, it is not the science

teacher who deals with this topic; instead it is presented in the social studies class. The science teacher feels that he cannot and should not teach social studies; the social studies teacher feels that he cannot adequately deal with the scientific aspects. The result, of course, is an incomplete understanding, a half-picture. The failure to recognize that each scientific discovery has its social implications takes the edge off the sword of scientific learning. The study of science as a compartment separate and apart from human affairs will be dull and certainly no incentive for progress. Nor will it result in an understanding of the role of science.

The foregoing would indicate the need for a closer integration of science and the other courses of the curriculum, particularly social studies. Life presents its problems whole. They must be dealt with so. By submitting to the various subject fields whole problems for illumination and solution, the students will sense that all the problems exist in all the fields and must be considered in the light of all the information and all the techniques available. By means of carefully planned integration the role of science in modern civilization can be made to assume its true stature in relation to that civilization.

At the present time, analysis of recent scientific discovery from the standpoint of its social role may lead the student to question the value of such discovery. He sees on all sides evidence that science is an evil force, plotting the destruction of himself and his culture. It is our duty to demonstrate that science can be perverted in the hands of a few people who do not think scientifically and who do not apply the method of science to a solution of their problems. We must, therefore, emphasize the fact that, far from being a force for evil, science can serve mankind by raising the standard of living and bringing about an economic understanding among nations which would make for lasting peace.

Modern science, when devoted wholeheartedly and unselfishly to the general welfare, has in it potentialities of which we do not yet dream. In dealing with this topic, the teacher must be sure not to display cynicism or to become iconoclastic. Students must recognize that it is when science is pursued for selfish interest that strife and warfare result.

One of the indices of the standard of living at any stage in man's development is the amount of energy man can directly control. More energy has come under man's control within the present century than had been used since the dawn of history. We have perfected methods of utilizing the energy to produce more materials without appreciably depleting our natural resources.

Vice-president Henry A. Wallace seems to support the belief that the findings of science and technology can aid in attaining a better standard of living when he states:

> Modern science, which is a by-product and an essential part of the people's revolution, has made it technologi-

cally possible to see that all of the people of the world get enough to eat. The peace must mean a better standard of living for the common man, not merely in the United States and England but also in India, Russia, China, and Latin America—not merely in the United Nations but also in Germany and Italy and Japan.

Ask your high school physical science class how many of them actually believe that in the present state of scientific knowledge all two billion of this planet's inhabitants could be provided with an *adequate* standard of living. Ask how many believe that the earth's crust could actually be made to yield the food, clothing, and shelter that such a standard of living would require. The responses will be enlightening and will suggest the extent to which the average layman can cope with scientific problems of socio-economic importance. The reactions will range from name-calling "globalony" to blind acceptance. The fact is that there is an answer to these questions and science is prepared to give it. Today the average layman finds himself expressing opinion or passing judgment on just such issues. He tries to discuss whether synthetic rubber shall be produced from grain alcohol or from petroleum. Shall the government sell the power of our large dams or would such action be a breach of freedom of enterprise? Buffeted on all sides by selfish interests which he probably fails to recognize, the average citizen lacks the knowledge to discern the truth.

Most of these scientifically rooted social problems revolve chiefly about a knowledge of the nature of materials and energy and their flow from one nation to another and through the community. When large masses of the social group have acquired the knowledge and skills which can aid in an understanding of the utilization of natural resources, either human or material, there will be less likelihood of conflict and a greater probability of operation for the social good.

The problem of the "have" and "have-not" nations, upon analysis, resolves itself into a lack of understanding with regard to the origin and the extent of natural resources. A handful of soil from Malaya has different potentialities from a handful of Pennsylvania coal. Each can be converted to the service of mankind. Our great problem is that of distribution. Knowledge which can help bring about more effective production and distribution of the raw materials of the earth will go a long way toward raising the level of living for all peoples, decreasing technological unemployment, and obviating a potent factor in precipitating war.

Tucked away among the back pages of the newspapers of November 28, 1943, there appeared a news item which certainly should have stimulated the careful reader to pause and reflect upon its significance. The article reported upon a statement of the Secretary of the Interior. Mr. Ickes declared that at the present rate of consumption our oil supply could be expected to last about ten years. He pointed out that if ever our automobiles are again to travel our roads in

the numbers they did before the war, we had better turn to the development of fuels derived from coal, of which there is an abundance.

How do you think your students will react to this obscure article? What will pass through their minds? Will they have adequate information to understand the cause and effect of a depletion of our oil? In short, do they understand the ways in which society is dependent upon natural resources and technology? An understanding of the nature and origin of materials and energy will become more useful as time goes by, for it will supply the necessary intelligence for coping with the increasing number of such problems.

Our natural resources are our country's life blood. In the past, we have misused and wasted much of our valuable heritage. This waste was due as much to sheer disregard for warnings of those who knew as it was from simple ignorance of the facts. We knew, for example, that oil is irreplaceable—once having been used, no more is produced to take its place. Failure to restrict the shortsighted interests which gain control over such resources has caused tremendous loss.

To an increasing extent, the citizen is being called upon to shape intelligent legislation in relation to our natural resources. If an informed citizenry votes on these issues, we can be sure that there will be less chance for self-interest to destroy what is common property. This is another responsiblity of the physical science teacher.

As an aspect of the same idea, let us consider our student as a future producer and consumer of the growing number of necessities of life and materials for enrichment of leisure. We hear so much, perhaps too much, of the wonders of science in store for us when the war is won. Startling developments in the field of electronics, new and unique plastic materials, air transportation with "no point on earth more than 60 hours from your nearest airport"—all presage the new world to come. Whether this new world will come within our lifetime is still a moot question. It is true, however, that we are, and will be, dealing with a larger number of the products of scientific investigation. It is the duty of physical science teaching to help train the scientist and craftsman and to provide a scientific-minded consumer who will examine facts and suspend judgment, and who will be able to understand what goes on under the hood of his car or in his vacuum cleaner or radio.

INDIVIDUAL ENRICHMENT

The role of physical science teaching as it relates to the individual has also become increasingly important. Within the past century, technological change has wrought many advances in methods of production. As a result there has been a decided increase in leisure time. A study of how this time is spent yields a rather dismal picture. By and large the time is dissipated and frittered away in amusements from which the individual profits little in a creative way. The avocational potentialities of the material handled in physical science offers

unique opportunity for the development of many worth-while leisure-time activities.

Of no little importance is the responsibility of physical science teaching to help the individual to achieve a coherent world picture. The kind of culture which a given society is capable of producing is determined in great measure by the interpretation that culture puts on the nature of the universe, of man's place in it, and of man's relations to that society and the individuals comprising it. Today, such considerations are particularly important because of the constantly growing number of instances in which science impinges upon unscientific beliefs. The personality which does not adequately cope with the problem of resolving this conflict is sure to suffer. The individual himself must work out his own solution, but science can help by offering a consistent and fairly complete viewpoint. When this viewpoint is clearly seen and applied, there emerges a world picture which can yield satisfaction and security.

Perhaps, to some extent, a portion of the world picture—the need for understanding our complex environment—must also be met by physical science teaching. Recent scientific advance promises to add many new devices ultimately designed to become commonplace. The results of electronic research and of experimentation in plastics promise much in this direction. It should be remembered, however, that there is a lag between the drawing board and the home. It is our job to explain the function and operation of these devices and at the same time to show clearly the problems of production which must be surmounted. After the war the airplane probably will not be as commonplace as the automobile, and a clear understanding why this is so must be clearly given.

WINNING THE WAR

A more immediate but highly important contribution which physical science teaching can make is the aid it can give in winning the war. Because many of the issues of the war have their roots in problems of science, the study of physical science will yield a broader understanding of what it is for which we fight.

The Army has recently instituted an orientation course designed primarily to introduce the inductee to the organization of the Army and to give him an understanding of why we must fight against the Axis nations even if it involves fighting on foreign soil. Examination of this course reveals that many of the ideas deemed necessary for an understanding of the problem are based on scientific fact. We therefore can do much in the science classroom to do the same job which the Army is so admirably doing. By presenting the scientific basis of many of the issues of the war to those on the home front and those about to be inducted we can aid immeasurably in hastening the day of victory.

Critical shortages in certain war materials have given rise to a complete reversal of policy in American advertising. Where formerly our aim seemed

to be to get the latest model regardless of whether the old one was still useful, we now consider it more fashionable to make the old one do. A knowledge of facts and skills from the field of physical science is sure to function in a wartime conservation program whose slogan is "make it do."

When America entered the war, our government was quick to recognize the material shortages which faced our war machine. Appeal was made to the public to participate in various scrap-collecting campaigns. Rubber, tin, aluminum, fat, paper, etc., were sought. Many individuals, unable to understand why these materials were urgently needed and how they were used, did not take part in the various salvage campaigns. A student is likely to be a more effective salvager of tin, for example, if he knows of the unique properties of tin and its use in the war effort. If only the remarkable connection between sugar and fat and explosives could be made clear to the average housewife, we could be sure that a continuous supply of the war materials for making gunpowder would be available.

We are fighting a highly mechanized war, one in which every tool of science is brought to bear in achieving our objective. Our Army must therefore be one of trained technicians capable of effectively using the machinery of modern warfare. Estimates show that nine out of ten soldiers are assigned to duties requiring special training. When our Army was small we could train the necessary number of men. With the rapid expansion through Selective Service the job of training became overwhelming. In August, 1942, the Army and the U. S. Office of Education requested the schools to institute pre-induction training courses. Based on critical Army shortages, these courses, with but few exceptions, contain material from the fields of physical science and mathematics. Physical science teaching throughout the nation has by and large accepted the challenge and instituted these courses. The collaboration between the educational forces and the armed forces of the nation speaks well for our democratic system of education. It is the duty of our schools to continue this training up to the very end of the war so that we may be sure that no American soldier is killed or wounded because we failed to do our part to provide adequate training.

It is indeed fortunate that the skills of war may be readily converted to the skills of peace. The pre-induction courses do not differ radically in content from the traditional physical science courses. Their emphasis, however, is upon adaptation to the needs of greater numbers of individuals. Therefore, the time spent in pre-induction training will, in all probability, yield results long after the war is over.

Some have expressed the opinion that the role of physical science in helping to win the war is by far the less timely job. They contend that what there is to do should have been done before the war started. Perhaps they are right, but of this, however, we can be sure. Having seen the importance of the material of physical science for

both war and peace, our educators will not omit this material from the curriculum. It is our job to see that the various curricula which we must draw up anew fit into the contemporary scene and make a definite contribution to it. The scientific way and its cultural richness must be infused into the lives of the people so that there will be just that much more mutual understanding.

This analysis of the role science teaching can play in modern life is based on the belief that the scientific method applies to all areas of living in a democracy; that scientific discoveries have wide social implications; that an application of scientific knowledge can raise the standard of living and enrich the life of the individual in countless ways.

In addition, science teaching can play a vital part in winning the war by helping to train our soldiers in the skills and knowledges needed in this most mechanized of all wars. Science teaching can further insure that our victory will result in lasting peace by pointing up the issues involved in war and demonstrating that many stem from half-knowledges, failure to think scientifically, and a misapplication of scientific and technological discovery.

Current Staff Publications

AT HOME WITH CHILDREN*

It is gratifying to read a book addressed to parents concerning their relations with preschool children which is written with clarity and concreteness. One needs to read only a few pages to sense that the authors have had years of experience with preschool children; hence their ability to offer innumerable suggestions and to write with conviction. They know children and know how to plan with them, play and work with them, to help them over hurdles, help them meet conflict and illness. The topics included in this book are those most parents are eager to have discussed, because they concern the essential interests of young children.

Indoor and outdoor play is described so that adults can better understand what contributes to children's satisfaction and what hampers them. The over-indulgent aunt, grandparent, or parent who reads this book will be given pause as he reads. The benevolent adult who wants to plan a party or picnic for a daughter or nephew from the first to the last detail will also come out shorn of ardor for such planning in the future. Children realize much happiness in planning and preparing for their own events, and their daily life should be kept simple and uncluttered. Although the authors do not specifically state their philosophy, they convey it forcefully and effectively in the way they offer suggestions, whether for the play corner in the kitchen, or the inclusion of the thimble in sewing equipment, "which the child won't use but likes to own," or the dining room chairs for playing train, or the construction of outdoor play equipment.

One of the fields of misunderstanding, and therefore of questionable guidance of preschool children, is in relation to their use of books. In Chapter 6, "Books and Stories," the very questions parents wonder about are answered so concretely that they will feel more secure in telling and reading stories and in choosing books for children's own use. However, if one chapter were to be selected above all others, it is Chapter 10, "Holidays, Parties, and Excursions." The suggestions and underlying reasons for helping children to enjoy important occasions are sensible, easy to put into use, but run counter to much current practice; indeed, they reveal the need for those who celebrate functions with children to mend their ways. Instead of the overstimulating, overtrimmed, commercialized birthday parties, Halloween parties and Christmas festivities, simpler and calmer functions in which the children share in the plans, make the decorations, and otherwise help in their own way are far more appropriate for preschool children and more fun for them.

Because introductions are often overlooked, special attention is directed toward the introduction to this book. How often one has heard parents and teachers express doubt about how to help children when there is serious illness or a death in the family. Those who feel dubious on this problem (and those who don't) should read the sensible suggestions offered in the introduction for meeting these difficulties.

* By Charlotte Gano Garrison and Emma Dickson Sheehy. Henry Holt and Company. 1943.

The authors address this volume to parents. While reading it, I could but wish that teachers at every level, principals, and all others who plan school programs and choose equipment would take the time to read it. The respect which the authors show for children's everyday play needs and interests, and their grand array of suggestions for selecting the right equipment, planning rooms, guiding group affairs, developing growth in music, science, and the arts will be bound to stimulate readers to a broader concept of guiding the work and play of older children.

ROMA GANS

EXPLORATION IN READING PATTERNS*

HERE is a book that should be read by all who are interested in the psychology and sociology of the reading of adults. As a matter of fact, it is as a contribution to the sociology of reading that it presents the greatest number of challenges. Dr. Strang believes that the only way one can really understand reading as a functional aspect in every person's life is to study it functionally. It is, of course, almost impossible to make a continuous case study history of a single reader over a life span. As a second approach, the method of case study was utilized, persons of various age groups, economic classification, intelligence levels, and the like being selected in order to determine how reading operates functionally in their lives.

It is no longer daring to present case studies in education. Dr. Strang, however, has approached the problem of the selection of case studies as a surgeon approaches the problem of collecting cases in his specialty. Each one has a contribution to make toward an hypothesis or toward a generalization. In this sense, the author's case studies lie in the interstitial area between the psychiatric case study and the statistical study in many variables. It is obvious that as a statistical study in many variables this book contributes significantly to the understanding of reading of adults, but it makes its greater contribution in trying to organize the various reading and personalistic elements into a functional unity of reading and of reader.

Dr. Strang's problem was the ever-present controversy between the atomist and the organicist. She solved that problem by being a little of each at different times in the book. She uses her data atomistically as evidence for the usefulness of the hypotheses she has developed from the case studies. In my opinion the hypotheses and their subsequent demonstration justify the complex organization of her study. These hypotheses are: that each reader is a complex personality; that reading habits, interests, and abilities in any reader are very complex; that the reader can comprehend what he has read better than he can express it; that there is a significant relationship between the reader's interest and his enjoyment of what he reads, his estimation of the difficulty of what he reads, and his actual proficiency in reading; that individuals read with their background of experience and emotions; that what the reader reads may be influenced by his special vocational, intellectual, or educational attainments, but that it is extremely difficult to predict what any individual will read; and finally, that some definite, dominant emotional and intellectual core of experience determines what a person will read. The case studies illustrate each of the seven hypotheses. The chapter which summarizes the data gives the evidence for the degree

* By RUTH STRANG. The University of Chicago Press. 1942.

to which the hypotheses are supported by atomistic evidence. The atomistic evidence corroborates the organismic hypotheses. Dr. Strang does not use atom in opposition to function. In her hands, the two approaches supplement each other in giving a more rounded view of the problems of reading and of the reader.

This book pioneers an understanding of the complexity of communication processes in, and among, adults.

IRVING LORGE

PRACTICING THE WAYS OF DEMOCRACY THROUGH THE GIRLS' LEAGUE*

IN this volume are set forth the theory and practice of those all-girl associations in secondary schools which correspond to the "Associated Women Students" customarily found in colleges. The term "Girls' League" is probably better known in the western states than in the east, but deans of girls all over the country have long realized the value of a general association open to girl students merely by virtue of their membership in the school, and serving to coordinate girls' activities as well as to promote a finer community spirit.

As the authors point out, everyone who has seen a girls' league in operation in a high school knows how potent such an organization can be in the promotion of a fine type of citizenship within the school community. Our public schools and colleges are now being questioned because they have in many respects failed to live up to the expectations of their critics. But the fine work that goes on quietly from day to day in a well run school, where pupils learn from their own experience in clubs and student councils the fundamental principles of democratic society, is too often overlooked because of preoccupation with particular aspects of the curriculum or with some administrative action that has stirred up controversy. Perhaps it is as well that the growth of student participation in government and the development of habits of good citizenship do not come in for too much public attention, since these are not plants which thrive under the glare of publicity. They need patient and thoughtful care—encouragement in the struggle toward ideals which are not always clearly understood by younger adolescents and which must be interpreted somewhat by more experienced leaders.

It may be asked why the authors place such heavy emphasis upon an organization which is for girls only, since the principles and procedures advocated—apply equally well to general student body associations. The reply would undoubtedly be that a great deal has been written about these general associations, while almost nothing has been published on the subject which this book treats. It emphasizes the importance of relating the girls' league to the general association, in the interest of a coordinated program for the school as a whole. To the girls themselves, according to the authors,

> . . . the league is an organization which makes them co-partners in the planning of the school's activities and gives to their activities dignity and importance equal to those of the boys; which offers participation to a large number of girls and gives individual girls a chance to develop their abilities and to increase their social skills by initiating and executing projects meaningful to them; which spells friendship, and brings certain satisfaction and security through which joyous experiences come. (p. 7)

This book is no dispassionate analysis of an educational device. It is written out of

* By SARAH M. STURTEVANT AND ETHEL ROSENBERRY. Bureau of Publications, Teachers College, Columbia University. 1943.

first-hand experience with girls' leagues, and with a strong conviction concerning their value in promoting democracy in our high schools. The authors believe that all teaching devices should be tested by the tenets of our common democratic faith, but find that unfortunately our schools are "honeycombed with practices that run counter to every particular" of this faith. "The school government organization, even if it does include both faculty and students, may still be run by a sponsor or a clique and so provide no useful learning in democratic ways of solving problems of school life."

> The shining ideal of democracy must find substance and meaning in the educational system where conflicts between autocratic and democratic ways of life are as real as they are in the larger community. . . . A Girls' League furnishes one device through which traditional beliefs and codes may be continuously rethought in the light of problems of human living as they occur in the school community. (p. 5)

Many specific suggestions are presented for organization and for programs that will enable a league to fulfill its purpose most effectively. The text abounds in references to practices followed by various leagues. And throughout the book the fundamental principles back of the activities are constantly stressed—character education, democratic living, and development of good citizenship. It would be hard to find a more eloquent plea for an educational device, or more helpful suggestions for using it to the best advantage.

The publication of this book just now, when we are being challenged to examine our daily practices in the light of our theories about democratic living, is most fortunate. The authors are no theoretical observers. Dean Rosenberry has long been an outstanding dean of girls in high school. Professor Sturtevant was not only a successful dean, but, until her untimely death last year, an inspiring teacher of deans, in close touch with conditions and professional developments throughout the country. The sincere belief of two such experienced educators in the possibilities of a girls' league in high school would alone constitute a very strong argument for careful study of the subject by school administrators. But with numerous examples of successful leagues to observe, and with this book to point the way, our high schools should feel encouraged to develop guidance programs that will be truly helpful in bridging the gap between democratic theory and practice.

HARRIET HAYES

Departmental Notes

Institute of Educational Research

DIVISION OF PSYCHOLOGY

Dr. Ella Woodyard, who was for the years from 1921 to 1941 first Assistant and then Associate in the Division of Psychology, was retired July 1, 1943. Her latest work at Teachers College was with Professors Arthur T. Jersild, Ernest G. Osborne, and R. C. Challman in a study of the rearing of children. She is now the Research Director of the Frontier Nursing Service at Wendover, Leslie County, Kentucky, a health demonstration in maternal and child welfare, under the direction of Mrs. Mary Breckenridge.

Division I

Foundations of Education

SOCIAL AND PHILOSOPHICAL FOUNDATIONS

Professor Edmund deS. Brunner spent January 4 to 7 in Washington at a conference of the U. S. Department of Agriculture Extension staff dealing with the 1944 program. He spoke on the work and problems of the county agent, on the basis of his field work of last summer, and led the discussion and summarized the final session.

Professor Wilbur Hallenbeck gave a series of lectures and discussions on "American Cities and Their Life and People" at the School of International Cooperation, New York City, December 13 to 20, inclusive.

PSYCHOLOGICAL FOUNDATIONS AND EDUCATIONAL RESEARCH

Professor Helen M. Walker has been elected president of the American Statistical Association for the year 1944. This is the first time since its organization, in 1839, that the Association has chosen a president from the field of professional education.

Division II

Organization and Administration of Education

Professor E. S. Evenden attended a meeting of the Commission on Teacher Education of the American Council on Education held in Chicago December 10 to 12. The Commission is in the last year of its work, and the meeting was devoted to consideration of the several reports of its work that are now in preparation. Professor Evenden is chairman of the Commission, and Professor Karl W. Bigelow is the director in actual charge of the Commission's program.

On December 8 Professor Paul Mort addressed the teachers of the Second Supervisory District Teachers Association at Bellmore, L. I., on the topic, "Education as a Powerful Instrument of Democracy." On December 14 he participated with Dr. Arvie Eldred of the New York State Teachers Association, Dr. Clyde B. Moore of Cornell University, and Dr. A. W. Schmidt of the New York State Department of Education in presenting the state aid program proposed by the New York State Educational Conference Board to representatives

of groups of New York City lay organizations called together by Mrs. Lewisohn, Secretary of the Public Education Association. On December 16 Professor Mort spoke before the Officers' Conference of the United Parents Association of New York City on "The Relationship Between School Expenditures and the Quality of Education," and on December 29 he addressed the Secondary School Principals of New York State, at Syracuse, on the topic, "What We Get for Our Money."

Division III
Guidance

At the annual meeting of the New York State Association of Deans and Other Guidance Personnel, Professor Esther Lloyd-Jones was elected president for the next two years. She has also been reappointed to the Student Personnel Work Committee of the American Council on Education. This committee is serving at the present time as a subcommittee of General Osborn's committee on the education of ex-service personnel, and has been asked to draft a guidance plan, national in scope, that will serve to implement the suggestions of the Osborn Committee. The Work Committee of the Council met in New York City on November 20. Professor Lloyd-Jones is also serving as president of the Horace Mann Parents' Association, which is working with the Lincoln Parent-Teacher Association to form one parent-teacher association of the Teachers College schools.

The Executive Committee of the Sarah M. Sturtevant Fellowship Fund is sponsoring a benefit concert by Rosalyn Tureck on March 4. Anyone who is interested in supporting the Sturtevant Fellowship Fund and anyone who enjoys Bach is cordially invited to attend this concert.

Among the talks that Professor Lloyd-Jones has made recently outside of Teachers College are the following: a lecture to the teachers of the Bushwick Health District on social relationships of the child in school life; four lectures to an in-service group of USO workers meeting at Russell Sage College; a talk on guidance to the parents of the Birch-Wathen School; and a talk to the West Point Women's Club on "Women as Leaders."

Professor Lloyd-Jones spent November 22 and 23 in Baltimore, studying the counseling system of the Glenn L. Martin Aviation Company. Miss Sallie Payne Morgan, who is assistant director of Engineering Personnel in this company, has received commendation in a national survey for the counseling work that she is doing with its women employees.

Professor Ruth Strang participated in the Bucks County Institute Program, held December 6 at Morrisville, Pa. She was one of the speakers in the panel, and served as leader for the two discussion periods on "Teaching Boys and Girls How to Read and Study."

Miss Pauline Williamson and Professor Strang, chairmen of the Health Education Section of the New York Society for the Experimental Study of Education, planned the general meeting on health education which will be held January 14. Miss Florence Myers, a Teachers College alumna, has accepted the secretaryship of the section.

Division IV
Instruction

CURRICULUM AND TEACHING

Professor H. L. Caswell met with a committee in Washington, D. C., on December 21 and 22 to consider ways in which attacks being made on modern instructional practices may be met.

PROFESSOR L. Thomas Hopkins addressed the teachers of Sewanhaka High School, Floral Park, N. Y., on November 22. His topic was "The Changing Curriculum."

MISS Alice Miel, who is an instructor in Curriculum and Teaching this year, is serving as a consultant to a group revising a course in Curriculum Materials at the State Teachers College in Danbury, Conn.

PROFESSOR Florence Stratemeyer met with the students at the State Teachers College in Danbury, Conn., on November 18, under the auspices of the local chapter of Kappa Delta Pi. She spoke on the topic, "Problems of Educational Leadership in the Postwar World." Her talk was followed by a group discussion.

CAPTAIN Harold Hand, a former student and instructor in Secondary Education at Teachers College, is serving as educational adviser with the Armed Forces in Cairo, Egypt. Captain Hand is planning college work for American soldiers for which they may receive credit in American colleges.

WORD has been received from Major George Muzzy, a former student and assistant in Secondary Education, who is being held as a prisoner of war by the Japanese in the Philippines.

PROFESSOR Emeritus Thomas H. Briggs is continuing his activities in the Consumer Education Study which is being carried on under the auspices of the National Association of Secondary School Principals. He divides his time between New York and Washington, D. C.

MUSIC EDUCATION

ON November 13 Professor Raymond Burrows gave a lecture on class piano instruction at Hackettstown, N. J. Before the lecture he gave a demonstration of beginning lessons with children.

PROFESSOR N. L. Church, as chairman of the recreation division of the Community Service Council of Hastings-on-Hudson, N. Y., had charge of the Community Christmas Festival. Professor Emeritus Peter W. Dykema was in charge of the singing program.

THE New York Office of the OWI has included Professor Howard A. Murphy's *String Quartet* among the American Chamber Music Works to be microfilmed and sent abroad.

HOME ECONOMICS

PROFESSOR Helen Judy Bond is serving as vice-chairman of the New York State Conference of Women Workers. A meeting of the group was held in New York on December 11.

PROFESSOR Clara Taylor spoke over station WNYC November 16 on the topic, "Are We Getting too Many Starches in Our Wartime Diets?" This was one of a series of broadcasts in the "Mealtime in Wartime" program sponsored by the New York City Nutrition Program.

ON November 15, at the American Common, Professor Grace MacLeod took part in a panel discussion held by the Common Council on American Unity, the subject being, "Nutrition Services Needed by Our Foreign-Origin Groups and What We May Learn from a Knowledge of Their Food Habits."

BUSINESS EDUCATION

AT the Chicago meeting of the American Vocational Association, Professor Hamden L. Forkner spoke on the subject of adjustments in vocational education as a result of the war. He has been appointed a member of the Postwar Planning Committee of the Association.

AN office machines text by Dr. Thelma M.

Potter and Albert E. Stern, *How to Use the Adding Machine*, has been published recently by Gregg Publishing Company.

HEALTH AND PHYSICAL EDUCATION

PROFESSOR William L. Hughes met with the National Convention Committee of the American Association of Health, Physical Education, and Recreation December 16 and 17 to plan the National Convention to be held in New York City in April, 1944. At the convention of the New York State Association for Health, Physical Education, and Recreation held at Syracuse December 28 to 30, Professor Hughes gave a talk and participated in panel discussions.

Division V
Nursing Education

PROFESSOR Elizabeth C. Burgess and Mrs. R. Louise McManus attended the conference of State Board of Nurse Examiners held in Chicago December 1 and 2. Professor Burgess opened the discussion on "The Evaluation of College Work Which Might Be Allowed for Credit in the Basic Program" and "Recognition for Four- and Five-Year Collegiate Nursing Programs." Mrs. McManus gave a report on the progress of the State Board Test Pool conducted by the National League of Nursing Education Committee on Educational Measurement and Guidance. She also spoke at a meeting in Cleveland, December 3, of the League of Nursing Education, taking as her topic "The Selection of Candidates for Schools of Nursing."

ON Friday evenings between November 5 and December 10 a series of addresses on "Problems of Health and Social Workers in Foreign Service" was given to students registered for the course, Nursing 220—International Aspects of Nursing, and to invited guests. Professor George S. Counts spoke on "A View of the Postwar World"; Miss Margaret Forsyth, on "Some Social and Religious Problems"; and Professor Isaac L. Kandel, on "Educational Problems." The following speakers also participated: Dr. James Mackintosh, professor of public health, University of Glasgow, Scotland, who spoke on "Some Aspects of Medical Relief in Europe"; Miss Effie J. Taylor, dean of the School of Nursing at Yale University and president of the International Council of Nurses, who discussed "The International Situation in Nursing"; and Miss Elizabeth Tennant of the Rockefeller Foundation staff, who is chairman of the Committee on Foreign Postwar Planning of the National Nursing Council on War Service and who gave a report dealing with this subject. Lieutenant Elizabeth Wright of the Army Nurse Corps related some of her experiences as an Army nurse in the Pacific area.

The Library

MISS Carrie E. Meares, supervising librarian of the Social Science Department, resigned on January 1 to return to the National Board of the Young Women's Christian Association.

Office of Field Relations and Placement*

The following list continues the appointments of Teachers College Alumni reported in the December RECORD.

Risoli, Clara Anne (A.M. 1936), instructor in English, Public High School, Chateaugay, N. Y.

Roe, Donald (A.M. 1941), principal, High School, Hosston, La.

Rosenblum, Joan (B.S. 1943), teacher of first

*Any student who is taking or has taken twelve points of work at Teachers College or any graduate of Teachers College may register with the Office of Field Relations and Placement. No fee is charged. For information write to the Placement Office for its booklet, *Employment of Teachers and Administrators.*

grade, Columbia Grammar School, New York, N. Y.

Rubinstein, Hermine S. (A.M. 1943), teacher of home economics, Winfield Park School, Winfield, N. J.

Saal, Hannah Sarno, dietitian, William S. Baer Company, Baltimore, Md.

Sager, Larettia K. (A.M. 1943), instructor in home economics, Senior High School, Oconto, Wis.

Sailor, Nelle Murray (A.M. 1942), supervisor of nutrition, Visiting Nurse Association, Boston, Mass.

Salzman, Edwin M. (A.M. 1937), director of music, High School, Farmingdale, N. Y.

Sammond, Marjorie (B.S. 1931), information attendant, Airline Terminal Building, New York, N. Y.

Schaeffer, Rudolf F. (A.M. 1941), instructor in German, Cornell University, Ithaca, N. Y.

Scherer, Sarah, teacher of special classes, Central School, Long Beach, N. Y.

Schermer, Bertha M., teacher of mathematics, Public High School, Austin, Minn.

Schilling, Roy Oren, supervisor of teaching, Eastern Oregon College of Education, La Grande, Ore.

Schneider, Grenafore Westphal, teacher of fifth, sixth, and seventh grades, Manhasset Bay School, Port Washington, N. Y.

Schwarz, Elizabeth (A.M. 1942), nursery school teacher, Church of All Nations, New York, N. Y.

Searles, Myrtle N. (B.S. 1937), director, Community Child Care Center, Inc., Paterson, N. J.

Selby, June (A.M. 1928), grade supervisor, Public Schools, Watertown, N. Y.

Shalit, Joan (A.M. 1941), teacher of music, Public Schools, Spring Valley, N. Y., and Stony Point, N. Y.

Shaw, Robert R. (Ph.D. 1931), vocational adviser, Rehabilitation Division, Veterans Administration, Denver, Colo.

Shostak, Jerome M. (A.M. 1942), teacher of seventh, eighth, and ninth grades, Lake Grove School, Lake Grove, N. Y.

Sigurdardottis, Aslang, nursery school teacher, Bethlehem Day Nursery, New York, N. Y.

Simco, Marie Louise (B.S. 1943), instructor and divisional supervisor, Stanford University School of Nursing, San Francisco, Calif.

Sondergaard, Arensa (A.M. 1933), primary teacher, Public Schools, Bronxville, N. Y.

Sparrow, Ruth Dorothy (A.M. 1941), teacher of first, second, third, and fourth grades, Public School, Pottersville, N. J.

Speer, Blanche M., head resident, Hampton Institute, Hampton, Va.

Stack, Estelle M. (A.M. 1943), assistant professor of clothing and textiles, University of Tennessee, Knoxville, Tenn.

Stidworthy, Margaret M. (B.S. 1941), teacher of social studies, High School, Great Neck, N. Y.

Taylor, Dorothy May, instructor in speech, New Jersey College for Women, New Brunswick, N. J.

Taylor, Harry F., associate professor of music, Catawba College, Salisbury, N. C.

Telling, Louisa C., housemother, The Masters School, Dobbs Ferry, N. Y.

Thigpen, Martha Rebecca (A.M. 1941), head teacher and supervisor, The Nursery School, Radford, Va.

Troeger, Elsie M. (A.M. 1933), director of cafeteria, Lyons Township High School, La Grange, Ill.

Turner, Marie A. (A.M. 1931), teacher of Spanish, High School, Clayton, N. J.

Van Duzer, Roberta R., executive secretary, Ocean County Health and Tuberculosis Association, Toms River, N. J.

Van Slyke, Marie L. (A.M. 1943), teacher of special classes, Public Schools, Ellensburg, Wash.

Van Til, William (A.M. 1935), researchist and writer, National Education Association, Washington, D. C.

Voigtlander, C. H. (A.M. 1943), teacher of Spanish and French, The Wheeler School, North Stonington, Conn.

Vreeland, Ellwynne M., assistant director, Albany Hospital School of Nursing, Russell Sage College, Albany, N. Y.

Wallace, Mildred E. (A.M. 1942), dean of girls, Roosevelt Junior High School, Peoria, Ill.

Washburn, Hildred L. (A.M. 1940), third grade critic teacher, Buffalo State Teachers College, Buffalo, N. Y.

Weaver, Pearl V. (A.M. 1943), educational director, St. Joseph's School of Nursing, Houston, Tex.

Alumni Activities

H. A. Prentice (Ed.D. 1940) is a lieutenant commander in the United States Coast Guard Reserve, having entered the service in May, 1942. He is on leave from the University of Vermont, where he is professor of physical education.

Thornton W. Merriam (Ph.D. 1934) is director of USO training, Army and Navy Department, National Council, YMCA, New York City. Dr. Merriam recently completed *Religious Counseling of College Students*, a report of a study conducted for the American Council on Education, and, in collaboration with Professor Frank Knight of the University of Chicago, he is continuing work on a volume entitled *Economics and Ethics*.

Benjamin Fine (Ph.D. 1941) is Education Editor of *The New York Times*. He is author of *Educational Publicity* (Harper and Brothers, 1943) and has under way an American history survey.

C. E. Myers (Ph.D. 1923) is supervisor of research, State Board of Education, Richmond, Va. He is also executive secretary of a state educational research council which is organizing a unified research program.

Marion Ferguson is public health nursing consultant, U. S. Public Health Service, Chicago, Ill.

H. C. Christofferson (Ph.D. 1933) is professor of mathematics and director of secondary education at Miami University, Oxford, Ohio. He is also assisting in the aeronautics program and is coauthor of a laboratory manual to be published and distributed by CAA and American Educational Council.

Elda Robb (Ph.D. 1934), director of the School of Home Economics, Simmons College, Boston, Mass., is beginning work on a graduate program in public health nutrition offered cooperatively by Harvard School of Public Health and Simmons College.

Roy C. Bryan (Ph.D. 1937) is principal of Western State High School, Kalamazoo, Mich.

A. H. Blankenship (Ed.D. 1943), who is superintendent of schools at Oak Ridge, Tenn., reports that the following Teachers College alumni are also in the Oak Ridge school system: Paul U. Antony, Lester Recktenwald, Margaret Marrs, Frances MacRobbie, Elsie Novy, John Richards, Jr., Johnnie Wallace, Grace Briggs, and Gwenna Lewis.

James B. Welles (Ed.D. 1936) is president of the State Teachers College at Geneseo, N. Y.

Edna E. Lamson (Ph.D. 1930), associate professor of education, State Teachers College, Jersey City, N. J., reports that she is still working on the results of a "Student Opinionnaire" constructed and administered in 1942.

Mildred B. Stanton (Ph.D. 1938) is senior supervisor of special education, State Department of Education, Hartford, Conn. She is working on the organization of a state program of education for the physically handicapped.

STEPHEN W. RYDER (Ph.D. 1935) is continuing his work as minister of the Flatbush Reformed Church, Saugerties, N. Y.

EDITH GANN (Ph.D. 1943) is acting vice-principal of Sussex Avenue School, Newark, N. J. Her doctoral dissertation, *Reading Difficulty and Personality Organization,* is being published by King's Crown Press.

J. LEROY THOMPSON (Ed.D. 1943) is superintendent of schools, Tarrytown, N. Y.

F. P. BOGLE (Ed.D. 1942) is a lieutenant (j.g.) in the United States Naval Reserve. He is instructor in navigation and seamanship, Naval Training School of Indoctrination, Quonset Point, R. I.

JOHN URBAN (Ph.D. 1943) is director of guidance, chairman of the science department, and assistant principal of the high school, Millburn, N. J. Dr. Urban's dissertation, *Changes in Overt Behavior Resulting from a Study of Communicable Diseases,* has been published by the Bureau of Publications, Teachers College.

R. H. BURPEE (Ph.D. 1940) is Program Director of the Overseas Department of the USO, New York City. His activities cover a wide range. At present he is attempting to develop programs in 165 clubs, a project which requires considerable research of a practical nature in the field of entertainment resources, athletic programs and equipment, and community relationships.

MAXWELL G. PARK (Ph.D. 1932) is head of the department of education, State Teachers College, Cortland, N. Y. Dr. Park taught at the Montana State University, Missoula, Mont., during the summer of 1943.

DOUGLAS SPENCER (Ph.D. 1938), assistant professor of psychology, Queens College, Flushing, N. Y., was recently elected president of the Queens College Chapter of the American Association of University Professors. He is also chairman of the Queens College delegation to the Legislative Conference of the City Colleges of New York City, and chairman of the Legislative Committee of the New York Association for Applied Psychology.

RUSSELL GALT (Ph.D. 1936), dean of Susquehanna University, Selinsgrove, Pa., has been occupied since last March with wartime reorganization of the college program and running the U. S. Army Air Corps Training Program for the detachment of aviation students at the university.

HELEN QUIEN STEWART (Ed.D. 1941) assumed in August, 1942, the directorship of the YWCA Residence for Girls in Boston, Mass. This residence houses 180 women and maintains a cafeteria. As chairman of the Residence Committee of the National Association of Employed Officers of the YWCA, Dr. Stewart is beginning a research project on the work load, professional status, and activities of the Directors of YWCA residences.

THERESA PYLE (Ph.D. 1939) is working with the U. S. Housing Service in Boston, Mass.

EDNA E. HAYS (Ph.D. 1936) is a member of the English department of Pine Manor Junior College, Wellesley, Mass.

MELVIN W. HYDE (Ph.D. 1932) has been dean of Mount Union College, Alliance, Ohio, since 1936. He recently completed two studies for the North Central Association: "A Study of Administrative Functions," and "The Institutional Purposes of Seventy-five North Central Colleges."

SIDNEY L. JACKSON (Ph.D. 1941), a first lieutenant in the Signal Corps, has been transferred from troop duty at Camp Crowder, Mo., to the Office of the Chief Signal Officer, where he is on the staff of the His-

torical Section Field Office. Lt. Jackson writes monographs about the current history of the Signal Corps, the details of which cannot be divulged. In addition to these official duties, he continues to write book reviews for the *Springfield Republican* and historical journals.

W. George Hayward (Ed.D. 1940) is principal of Elmwood Elementary School, East Orange, N. J. During the summer of 1943 he taught at Lehigh University, Bethlehem, Pa., and is still teaching a Saturday class in reading at Lehigh. Dr. Hayward has been appointed to the State Board of Examiners for two years and is vice-president of the Elementary Principals Association of New Jersey and president of the Lions Club of the Oranges.

V. Neal Maricle (Ph.D. 1938), Associate State Secretary, YMCA, Boston, Mass., completed an agency survey of the Cambridge YMCA during the summer and will soon undertake a similar survey of the YMCA in Lynn, Mass.

Hale Pickett (Ph.D. 1938) is head of the department of mathematics, State Teachers College, West Chester, Pa.

B. A. Liu has been connected with the Chinese News Service, New York City, since March 1, 1943, as a member of the research staff. He is at work on research projects pertaining to China's postwar international relations.

Sara E. Smith (Ed.D. 1940), associate professor of education, Western Maryland College, Westminster, Md., writes that the department of which she is a member is in the process of changing to a program providing more student teaching, less conflict between educational and academic subjects, and more concentration of education work in the last half of the senior year. Dr. Smith is working on a freshman course in remedial reading and at present is also teaching chemistry part of the time to the ASTP classes.

Royce S. Pitkin (Ph.D. 1933) is president of Goddard College, Plainfield, Vt.

Eugene Lambert (Ed.D. 1942) is head of the department of physical education at the University of Arkansas, Fayetteville, Ark. His work includes special duties as director of athletics, basketball coach, and director of physical training for 1300 Army trainees.

Kenneth F. Damon (Ph.D. 1933) is vice-president and general manager of Johnson Consumer Industries, Inc., Maspeth, L. I.

Agnes Tilson Adcock (Ph.D. 1929), in addition to being a homemaker, volunteer Red Cross worker, and lecturer to parent-teacher associations, clubs, and home economics groups, teaches one three-hour class at Butler University, Indianapolis, Ind.

Hubert J. McCormick (Ed.D. 1940) assumed active duty as Lieutenant, USNR, on March 15, 1943. He took officer's indoctrination at Tucson, Ariz., and is now stationed at Naval Training Unit V-12, University of North Carolina, Chapel Hill, N. C. Lt. McCormick is on leave of absence from the University of Wyoming, where he is professor of physical education and director of health and physical education.

Anna M. Gemmill (Ph.D. 1934), head of the science department, State Teachers College, Buffalo, N. Y., is occupied with a departmental study of present curriculum and changes that may be required after the war.

May Hollis Siegl (Ph.D. 1933) is state supervisor of elementary education and director of training, State Normal School, Castleton, Vt. She has under way a cadet supervision project in connection with a teacher training program. Dr. Siegl is a member of the State Language Arts Curriculum Committee.

MARGARET RUTH SMITH (Ph.D. 1937) is director of student activities at Wayne University, Detroit, Mich.

WILLIAM S. TAYLOR (Ed.D. 1943) is dean of education at University of Kentucky, Lexington, Ky. He has been sponsoring a county workshop program in Kentucky to aid in providing professional training for the emergency teachers now being used in the schools.

ELIZABETH LEE VINCENT (Ph.D. 1924) has been psychologist at Merrill-Palmer School, Detroit, Mich., since 1925. She is also a member of the staff of Children's Hospital of Michigan and a lecturer at the Detroit College of Medicine, the Graduate School of Public Affairs and Social Work, Wayne University, and the graduate School of Education, University of Michigan. She is coauthor of *Child Development: Physical and Psychological Development Through the School Years* (Saunders, 1943).

C. MAURICE WIETING (Ed.D. 1942) is confidential secretary to James C. Marshall, superintendent of Schools, New York City.